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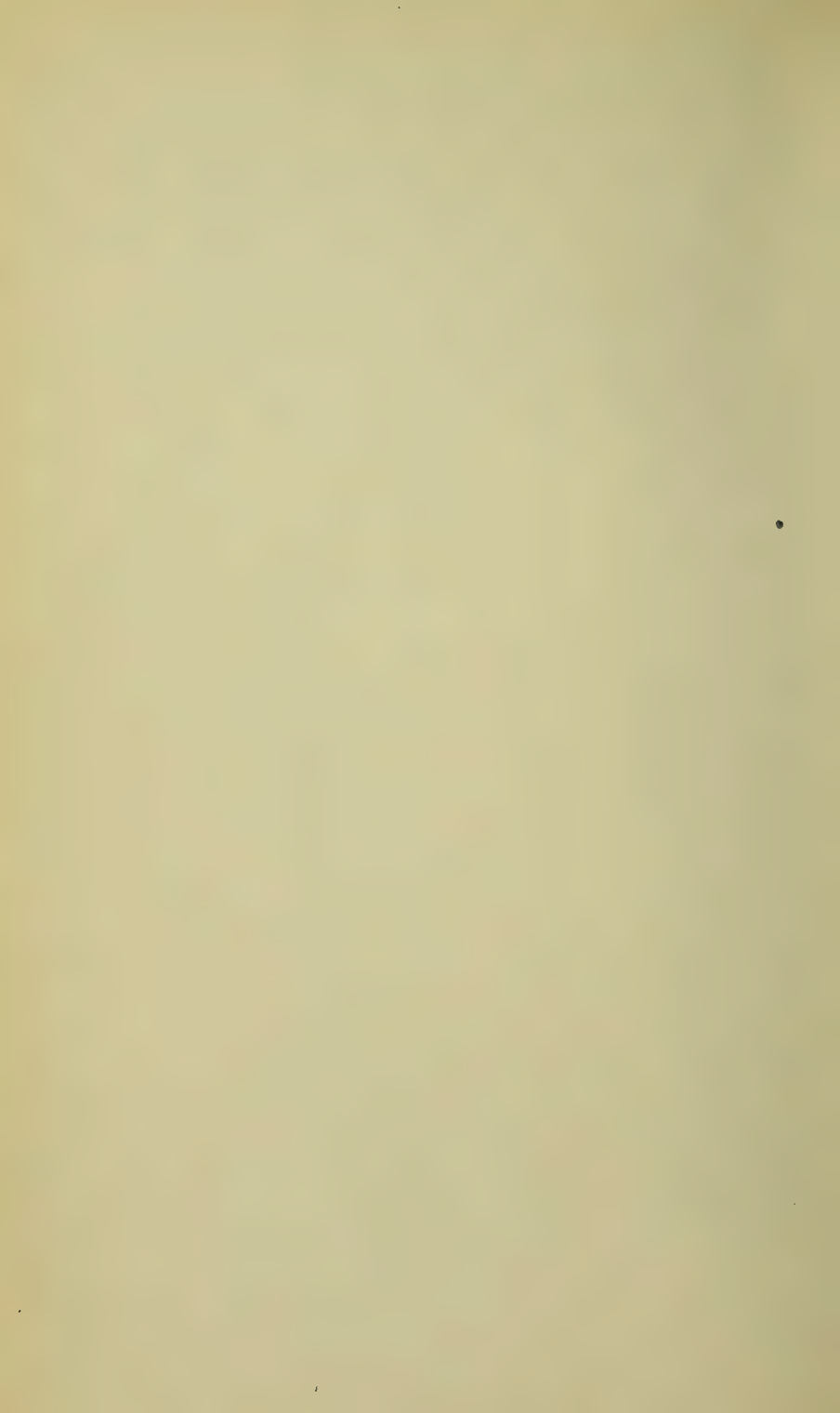
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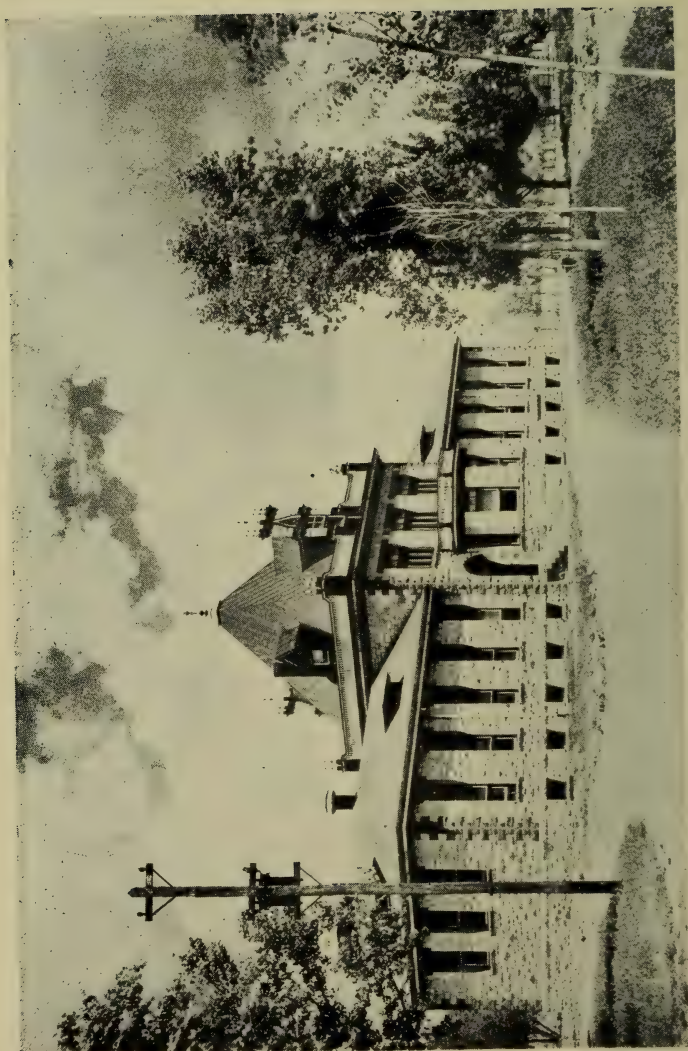
ANNUAL REGISTER
OF THE
NEW MEXICO
STATE
SCHOOL OF MINES
SOCORRO, N. M.

1916-1917

With Announcements for 1917-1918







MAIN BUILDING

ANNUAL REGISTER
OF THE
NEW MEXICO
STATE
SCHOOL OF MINES
SOCORRO, N. M.

1916-1917

With Announcements for 1917-1918



CALENDAR.

1917.

First Semester :

September 17, Monday—Registration of students.

September 18, Tuesday—Class work begins.

November 29, Thursday—Thanksgiving.

December 21, Friday, 4 P. M.—Holiday recess begins.

1918.

January 2, Wednesday—Work resumed.

January 23, 24, 25—Examinations.

Second Semester :

January 28, Monday—Second semester begins.

February 22, Washington's Birthday—Holiday.

May 20, 21, 22—Final examinations.

May 23, Thursday, 8:30 P. M.—Commencement.

BOARD OF REGENTS.

HIS EXCELLENCY, E. C. DE BACA, <i>Governor of New Mexico, ex-officio</i>	Santa Fe
HON. J. H. WAGNER, <i>Superintendent of Public Instruction, ex-officio</i>	Santa Fe
A. C. TORRES.....	Socorro
JOHN MCINTYRE	San Antonio
W. M. BORROWDALE.....	Magdalena
W. R. MORLEY.....	Datil
J. L. NICHOLAS.....	Socorro

OFFICERS OF THE BOARD.

A. C. TORRES.....	President
JOHN MCINTYRE.....	Secretary and Treasurer
MRS. BLANCHE E. REED.....	Clerk of Board

FACULTY.

FAYETTE ALEXANDER JONES.....*President*

C. E., E. M., State School of Mines, University of Missouri, 1892; Engineer, Union Mining Company, Phoenix, Ariz., 1893; Topographic Engineer for sewer system, Independence, Mo., 1894; Chief of topographic surveys, Isthmus of Tehuantepec, 1894-5; Mining Engineer, Phoenix, Ariz., 1896; U. S. Assayer at Kansas City, 1896-8; Chemist of Missouri State Geological Survey, 1897-8; President New Mexico School of Mines, 1898-02; LL. D., Nashville College of Law, Tenn., 1903; Field Assistant U. S. Geological Survey, 1901-6; Member New Mexico Board of Exposition Managers to International Exposition at St. Louis and chairman of Committee on Mines and Mining, 1903-4; Statistician of U. S. mint for precious metals of New Mexico, 1904-06; Geologist, Colorado, Columbus & Mexican Railway, 1908-9; Chief of expedition and mineralogist to Island Tiburon in Gulf of California, 1909; Mining Engineer, Grants Pass, Oregon., 1910-11; Chief of geological and mineralogical explorations through central British Columbia along proposed line of Grand Trunk Pacific Railway, 1911-12; re-elected President New Mexico State School of Mines, 1913—; Author, Mem. Am. Inst. of Mining Engineers, etc.

GUSTAVUS EDWIN ANDERSON.....

.....*Professor of Geology and Mineralogy*

S. B. in Geology, University of Chicago, 1905; A. M. Columbia University, 1906; Assistant in Geology, Columbia University, 1905-06; University Fellow in Geology, Columbia University, 1906-7 Professor of Geology, Imperial Mining College, Wuchang, China, 1907-09; Geologist for the Han Yang Iron Works, Han Yang, China, 1908-09; Associate Professor of Geology, Pennsylvania State College, 1909-1911; in charge of field work on the Belle Fonte Quadrangle, State College, Pa., 1908-09; Professor of Geology and Mineralogy, New Mexico State School of Mines since 1911.

THOMAS CALVIN MACKEY....*Professor of Physics, Mathematics*

A. B. Dalhousie University, 1893; Principal of Baddeck Academy, 1893-94; Principal of Parrsboro High School, 1894-96; Graduate student at Dalhousie University, 1896-98; A. M. at Dalhousie 1898; A. M. at Harvard, 1899; Assistant in Physics at Harvard University, 1899-1900; Austin Teaching Fellow at Harvard, 1900-1901; Assistant at Harvard and Radcliffe, 1901-04; Ph. D. at Harvard, 1903; Instructor in Physics at the University of California, 1904-09; Demonstrator in Physics at Dalhousie University, 1909-10; Professor of Physics at Mt. Allison University, 1910-11; Professor of Physics and Mathematics at the New Mexico State School of Mines, 1911—; Author of a text-book on physical measurements and of various papers on physical subjects.

ALEXIS XAVIER ILLINSKI.....*Professor of Chemistry*

B. S. in Chemistry and Metallurgy, School of Mines and Metallurgy, University of Missouri, 1909; Met. E., School of Mines and Metallurgy, University of Missouri, 1916; Superintendent of Underground Diamond Drills, Federal Lead Company, Flat River, Missouri, 1906-7; Superintendent of Canvas Plant, Federal Lead Company, Flat River, Missouri, 1907-8; Chemist, Missouri Geological Survey, Rolla, Missouri, 1909-12; Instructor in Metallurgy and Ore Dressing, School of Mines and Metallurgy, Rolla, Missouri, 1912-14; Experimental Research Station, School of Mines and Metallurgy, Rolla, Missouri, 1914-15; Professor of Chemistry, New Mexico State School of Mines, 1915—.

ARTHUR WILLIAM FAHRENWALD.....

.....*Professor of Mining and Metallurgical Engineering*

Homestake Mining Company, Lead, South Dakota, 1912-13; B. S. South Dakota State School of Mines, 1914; Mining Engineer, Marquette Portland Cement Mfg. Co., La Salle, Ill., remainder of 1914 and in 1915; on flotation, Butte and Superior Copper Co., Butte, Montana, 1915; Met. E., South Dakota School of Mines, 1915; E. M., New Mexico State School of Mines, 1916; Professor of Mining and Metallurgical Engineering, New Mexico State School of Mines, 1915—.

ERNEST CHARLES WHITE.....*Professor of Civil Engineering*

B. S. Norwich University, 1908; C. E. Norwich University, 1915; Assistant Engineering Corps, Missouri Pacific Railway, 1908-09; Transitman, Boston Elevated Railway, 1909-10; Transitman in charge of survey of City of Everett, Massachusetts, 1910-11; Instructor in Civil Engineering at Cornell University, 1911-16; Summers of 1912-13-14-15 with B. & A. Ry.; U. S. Valuation Board, and Baltimore & Ohio Railroad; Professor of Civil Engineering, New Mexico State School of Mines, 1916—.

VIGGO EMMANUEL HANSON.....

.....*Professor of Mechanical Engineering*

B. S., State University of South Dakota, 1910; on erecting floor, Blake Knowles Pump Works, East Cambridge, Mass., 1910-11; Draftsman, Blake Knowles Pump Works, East Cambridge, Mass., 1911-12; Assistant Professor of Civil Engineering, New Mexico State School of Mines, 1912-14; Professor of Mechanical Engineering, New Mexico State School of Mines, 1914—.

JOHN BUCHANAN GUNTER.....*Principal Academic Department*

B. Pd., New Mexico Normal School at Silver City, 1911; Principal of Public School, San Marcial, N. M., 1911-12; Instructor in New Mexico Normal School (summer sessions), 1911 and 1913; M. Pd., New Mexico Normal at Silver City, 1913; Superintendent of Public Schools at Belen, N. M., 1912-14; Principal Academic Department, New Mexico State School of Mines, 1914—.

MANUEL A. SANCHEZ.....*Instructor in Spanish*

P. A. MARCELLINO.....*Instructor in Band Music*

MRS. BLANCHE E. REED.....*Registrar and Librarian*

NEW MEXICO STATE SCHOOL OF MINES

HISTORICAL SKETCH.

The New Mexico State School of Mines was founded by Act of the Legislature of 1889. The Act provided for the support of the School by an annual tax of one-fifth of a mill on all taxable property.

Under an Act of the Legislature, approved February 28, 1891, a board of trustees was appointed. Organization was effected and immediate steps were taken towards the erection of necessary buildings. In the same year a special appropriation of \$4,000 was made for the partial equipment of the chemical and metallurgical laboratories.

Early in 1892 a circular of information regarding the New Mexico School of Mines at Socorro, New Mexico, was issued by the Board of Trustees. In this circular the aims of the institution were fully set forth. The following year a president was chosen and students in chemistry were admitted; but it was not until the autumn of 1895 that the mining school was really opened.

In 1893 a second special appropriation of \$31,420 was made to enable the School of Mines to be organized in accordance with the policy outlined by the Act creating the institution.

By Act of Congress, approved June 21, 1895, the New Mexico School of Mines received for its share of certain grants of land fifty thousand acres for its support and maintenance. From this source of revenue the school has already received more than \$40,000.

In 1899 the Legislature increased the former levy of one-fifth of a mill to twenty-seven and one-half one-hundredths of a mill.

In 1901 the Thirty-fourth General Assembly recognized the growing importance of the School by further increasing the tax levy to thirty-three one-hundredths of a mill. It also authorized the bonding of any portion of the grants of lands in order to more thoroughly equip the School with buildings and apparatus.

In 1903 the Thirty-fifth General Assembly raised the millage to forty-five one-hundredths of a mill. This, with greatly increased assessed valuation of property, doubled the income of the school over that of the previous year.

Since 1903 the appropriation for the support and maintenance of the School of Mines has been increased at each session of the General Assembly. At the first session of the State Legislature the appropriation was raised to \$22,500 a year.

The Second State Legislature of 1915 provided the additional fund of \$20,000 for machinery and metallurgical equipment, which sum is now being spent to carry out the purpose intended.

By the terms of the Enabling Act under which New Mexico was admitted to statehood, the School of Mines becomes possessed of an additional 150,000 acres of land. Most of this land has now been selected and will soon become the source of a very considerable revenue to the institution.

STATUTES RELATING TO THE SCHOOL.

Some of the sections of the Act creating the School of Mines are as follows:

The object of the School of Mines created, established and located by this Act is to furnish facilities for the education of such persons as may desire to receive instruction in chemistry, metallurgy, mineralogy, geology, mining, milling, engineering, mathematics, mechanics, drawing, the fundamental laws of the United States and the rights and duties of citizenship, and such other courses of study, not including agricultural, as may be prescribed by the Board of Trustees.

The management and control of said School of Mines, the care and preservation of all property of which it shall become possessed, the erection and construction of all buildings necessary for its use, and the disbursement and expenditure of all moneys appropriated by this Act, or which shall otherwise come into its possession, shall be vested in a board of five trustees, who shall be qualified voters and owners of real estate; and said trustees shall possess the same qualifications, shall be appointed in the same way, and their terms of office shall be the same, vacancies shall be filled in like manner, as is provided in Sections 9 and 10 of this Act. Said trustees and their successors in office shall

constitute a body under the name and style of "The Trustees of the New Mexico School of Mines," with right as such of suing and being sued, of contracting and being contracted with, of making and using a common seal and altering the same at pleasure, and of causing all things to be done necessary to carry out the provisions of this Act. A majority of the board shall constitute a quorum for the transaction of business, but a less number may adjourn from time to time.

The immediate government of their several departments shall be intrusted to the several faculties.

The board of trustees shall have power to confer such degrees and grant such diplomas as are usually conferred and granted by other similar schools.

The trustees shall have power to remove any officer, tutor or instructor or employe connected with said School when, in their judgment, the best interests of said School require it.

The board of trustees shall require such compensation for all assays, analyses, mill-tests, or other services performed by said institution as they may deem reasonable, and the same shall be collected and paid into the treasury of the School of Mines for said institution, and an accurate account thereof shall be kept in a book provided for that purpose.

LOCATION.

The New Mexico State School of Mines is located at Socorro, the county seat of Socorro County, on the main line of the Atchison, Topeka and Santa Fe Railway, 75 miles south of Albuquerque, and 180 miles north of El Paso. The Magdalena branch of the Santa Fe railway starts from this place.

Socorro is situated in the valley of the Rio Grande at the foot of the Socorro range of mountains at an elevation of 4,600 feet above the level of the sea. The surrounding scenery is diversified by plains, valleys, mesas, hills, and mountains. The climate of the locality is preeminently pleasant and healthful, and has long attracted health-seekers who would escape the rigors of less favored localities. The air is exceedingly dry and the temperature is mild and equable. Socorro's public water supply comes from warm springs that issue from Socorro mountain three miles

away. The water is famed for its purity and has always been an attraction to visitors and residents.

The ground immediately adjacent to the School of Mines includes irrigable land, plateaus and mountain formations, all affording an excellent field for practice in surveying, the laying out of railroads and irrigating canals, topography, mine engineering and geology, so that students can be prepared at the very door of the school in those branches which usually require tedious excursions from most other schools. Almost the entire geological column is here exposed.

The New Mexico State School of Mines enjoys the natural advantage of being located in the midst of a region peculiarly rich in minerals of nearly all kinds, and is within easy reach of the most varied geological conditions, all of which are within a radius of thirty or forty miles of Socorro. The industrial processes connected with mining and metallurgy may be seen admirably illustrated at Mogollon, Kelly, White Oaks, San Pedro, Hillsboro, Lordsburg, Fierro, Silver City, Pinos Altos, Santa Rita, Burro mountains, Los Cerrillos, Dawson, Gallup, Carthage, and elsewhere within easy reach of the School. These illustrate the most modern methods of mining, milling, ore-dressing, concentrating, lixivation, cyaniding, and other metallurgical processes.

A number of mines of various kinds, smelters, irrigation systems, and other engineering works are accessible to the School. Within a few hours ride by rail are many important mining camps. The longer excursions bring the student to some of the most famous mines in southwestern United States. Some of the oldest worked lodes in America are in this region. Gold and turquoise were first noted by the *conquistadores* in 1540-2 by the celebrated expedition of Francisco Vasquez de Coronado, when in search of the Gran Quivira, one of the seven cities of Cibola. The first modern discovery of gold west of the Mississippi was made in New Mexico at the base of the Ortiz mountains, in Santa Fe county, in the year 1828. The first copper mined west of the Mississippi river was at Santa Rita in Grant county, in 1800. The metal from these copper mines was transported on the backs of burros to Mexico City and thence sent to the royal

mint of Spain to be made into coin. The Chino Copper Company now operates these celebrated mines. Among the great wonders of the West are the ancient turquoise workings at Mount Chalehuítl near Los Cerrillos. An ancient lode mine, known as *Mina del Tierra*, is situated near the ancient turquoise workings. Verily, New Mexico is the birthplace of American mining.

The history of modern mining schools shows that each becomes most celebrated along the line for which its locality is best known on account of its natural surroundings. Few institutions of learning are more dependent for success upon what may be called the accident of geographical location. It may be truthfully said that no mining school is more fortunately situated so far as natural environment is concerned than that of New Mexico.

PURPOSE.

The ideal to which the New Mexico State School of Mines tenaciously holds is the practical directing of young men to take active part in the development of the mineral wealth of the world.

The School is a state institution. It was established primarily to promote the development of the mineral resources of New Mexico and to provide facilities for the young men of the state to secure a practical education in all departments of mining. Naturally, however, the institution's field of usefulness has steadily grown broader. Not only New Mexico, but also other parts of the southwest have felt its influence through its graduates in the development of the mining industries of this great region. Moreover, a considerable number of students from other parts of the country who desired to avail themselves of the peculiar advantages of this region have come to the School of Mines for the training they needed and the number of such young men is constantly increasing.

During the entire period of his training the fact is impressed upon the mind of the student that intelligent mining is a business operation capable of being put on as secure a foundation as any other; that from beginning to end it is akin to all other great business undertakings. While lucky finds will doubtless continue to be made, mining is no longer to be considered a mere lottery appealing to the gambling propensities.

During the past quarter of a century the development of the mineral wealth of the nation has been phenomenal and the calls for adequately prepared young men to direct mining enterprises in all their various ramifications have been rapidly increasing.

ADVANTAGES.

Several features contribute to the success of this institution as a school of mines:

The unique natural surroundings of the School already described create an invigorating mining atmosphere which is entirely wanting in institutions remote from the mines and mountains.

In the training offered by the School there is noteworthy concentration of effort. There are many advantages in the direction of effort along few lines. In contrast with the many diversions that necessarily exist in those technical institutions of learning where all practical branches are equally represented, singleness of purpose is a leading feature of the New Mexico State School of Mines. The concentration of energy growing out of the special method of instruction happily adapts the student so that he gets the most out of his efforts.

The student is required as an integral part of his course to visit and critically inspect, under the direct supervision of his instructors, various plans and works and to make intelligent reports. Being obliged from the start to make the most of the exceptional opportunities presented, he quickly falls into the spirit of his present and future work and at once necessarily acquires for his chosen profession a sympathy that is seldom attained, except after school days are over and after long and strenuous effort.

Being within short distances of mines and smelters, the student has the opportunity of finding regular employment during his vacation and of acquiring desirable experience in practical work.

The field for scientific research in New Mexico is unrivalled and the opportunities here offered are not neglected in the plan and scope of instruction. New Mexico, so far as concerns the mountainous portions, which comprise about two-thirds of its area and is nearly all mineral-bearing, is perhaps less known geologically than any other section of the United States. A little

study of the plateau region of the northwestern portion of the state has been made by the United States Geological Survey, but only in a general way. No attempt has ever been made under government auspices to investigate closely the geological structure of New Mexico mountains such as have been carried out in the other Rocky Mountain states, or to study the conditions of New Mexico mineral deposits as has been done in Colorado by Emmons, in Nevada by Curtis, in California by Becker, and in other states by other distinguished investigators.

Much of the advanced professional work of the School is of an original nature to the end that the graduates may be skilled, theoretically and practically, in the very problems which they as professional men will be called upon to solve. This work is carried on by the advanced students under the direction of the professors and involves the collection of notes, sketches, maps, and specimens, and the results of directed observations in all matters relating to the sciences and arts embraced in the courses of study. The subjects for such researches in geology and mining and in the reduction of the ores of lead, silver, gold, copper, and zinc are so numerous that it is impossible to do more here than to mention the fact that the conditions of climate, drainage, water-supply, and geological structure in New Mexico differ greatly from the conditions existing in other parts of the Rocky Mountains, thus giving rise to new problems in practice. These problems are not by any means all that deserve attention. The investigators of the ores of iron, manganese, aluminum, cobalt, nickel, tin, and quicksilver, vanadium, and uranium, together with the beds of coal, salt, alum, building stones, mineral-paints, cement-rock, marls, etc., are directly in line with the advanced laboratory work of the School, and every student who undertakes such work is encouraged in every possible way to accomplish the best results.

ORGANIZATION.

The general management of the New Mexico State School of Mines is vested in a Board of Regents consisting of five members appointed by the Governor of the State with the concurrence of the Senate for a term of four years. The Board of Regents elects a president from its members and also a secretary and treasurer. The appointment of a president of the faculty of

the School is also made by them, as well as the selecting of a teaching staff.

By Act of the Legislature, the maintenance of a preparatory department is required of the higher educational institutions of the state. The New Mexico State School of Mines, therefore, is composed of the College and the Academy.

THE COLLEGE.

Requirements for Admission.

Candidates for admission to the College are required to present a statement from some school of recognized standing certifying that they have completed and received a passing grade in the following subjects: Elementary Algebra, Plane and Solid Geometry, Physical Geography, ninth, tenth and eleventh grade English, and one year of Elementary Physics, Chemistry, and Geology. Those candidates who are unable to present such a statement may take an examination by the Principal of the Academy on any of the foregoing subjects to determine their proficiency therein. Graduation from accredited high schools of this and other states will admit the student to the College work without examination.

Registration.

No student will be allowed to register for any subject until the pre-requisites are credited to him on the school records. Therefore the student is advised not to delay either in making up any deficiencies which may exist or in obtaining from the School the credits which may be due him for work done elsewhere.

Advanced Standing.

Credits for courses required in the College will be given to students either upon their passing an examination in such courses or upon their presentation of a certificate from an approved educational institution showing that they have satisfactorily completed such courses; provided that no more than the first three years of the curriculum be thus credited to a student who has not yet received the Bachelor's Degree. Certificates of credit for such courses must be presented, or examinations for credits must be arranged for, at or before the time of matriculation.

Irregular Students.

Students who are irregular but who intend to graduate will be required to complete the courses in which they are delinquent as soon as possible and to become regular. It cannot be urged too strongly that students expecting to matriculate with this institution come prepared to take up the work without conditions. Every candidate for admission to the School may rest assured that after entrance his time will be fully occupied.

Special Courses.

Students desiring to take special courses without a view to graduation may do so provided that they give evidence of proficiency in the prerequisite subjects and that their taking such courses does not interfere with the regular schedule of classes.

The curricula of the College are planned especially to meet the needs of students intending to engage in mining or metallurgical industries, in mine-experting, surveying, railway and engineering construction. Accordingly, curricula are offered in the following.

Curricula.

MINING ENGINEERING.

METALLURGICAL ENGINEERING.

GEOLOGICAL ENGINEERING.

CIVIL ENGINEERING.

Each curriculum covers four years. Upon the satisfactory completion of either of them the Bachelor's degree is given. The Master's degree is conferred upon graduates of the School of Mines who have spent two years in professional work, at least one of which must have been in a position of responsibility, and who present a satisfactory thesis.

In the adjustment of the courses of the several curricula, it is assumed that one period of work in the class-room requires two periods of preparation, and therefore that one period of work in the class-room is equivalent to three periods of work in the field or in the laboratory. In the following outlined statement of curricula the number of periods per week required in the class-room and in the field or in the laboratory are given separately. The number of periods required in the field or in the laboratory represents *average* time, however, inasmuch as it is frequently

advantageous, especially for field work, to concentrate into one week an amount of work equal to that which would require two or more weeks if performed in separate installments.

Short Courses.

For the benefit of resident young men of the state short courses of a few weeks' duration will be given in prospecting, assaying, mineralogy, surveying, chemistry, mechanics, electricity, etc. Such a departure from the full college courses ought appeal to those who wish to attain greater efficiency, which will mean a corresponding increase in wages.

UNIFORM CURRICULUM FOR THE FIRST TWO YEARS.

The curriculum for the first and second years of the four courses offered at the School of Mines is the same in all respects. This arrangement is of advantage to the student, as it gives him until the beginning of the third year to determine for which of the four courses he is best fitted by inclination or aptitude.

Mathematics, physics, and chemistry are fundamental subjects for the successful engineer. For that reason the two first years of all the engineering courses are devoted to a thorough grounding in those three subjects as will be seen in the tabular statement below. Specialization does not begin until afterwards.

Excellent facilities are offered for the acquisition of a thorough knowledge of these subjects so necessary to successful engineering work both during the remainder of the course and during a professional career.

UNIFORM CURRICULUM.
FIRST YEAR.

Course Numbers	Courses.	Periods per week	
		Class	Lab'y
First Semester			
I. 1.	Algebra	5	
I. 2.	Trigonometry (Plane)	5	
I. 3.	Analytic Geometry	3	
III. 1.	General Chemistry	5	6
VIII. 2.	Shop		6
VIII. 3.	Mechanical Drawing		6
Second Semester			
I. 1.	Advanced Algebra	3	
I. 2.	Trigonometry (Spherical)	2	
I. 3.	Analytic Geometry	2	
III. 1.	General Chemistry	5	
IV. 1.	General Surveying	2	4
VIII. 3.	Mechanical Drawing		6
VIII. 6.	Descriptive Geometry	3	
III. 2.	Qualitative Analysis	2	9

UNIFORM CURRICULUM.
SECOND YEAR.

Course Numbers		Courses. First Semester	Periods per week	
			Class	Lab'y
I.	4.	Calculus	5	
II.	1.	Experimental Mechanics	3	3
III.	3.	Quantitative Analysis	1	9
IV.	3.	Mine Surveying and Mapping.....	2	4
IV.	2.	Topographic Surveying	2	4
V.	1.	Mineralogy	3	3
V.	2.	General Geology	2	
III.	8.	Physical Chemistry	2	
Second Semester				
I.	5.	Calculus	5	
II.	2.	Heat and Light.....	3	3
III.	5.	Water and Fuel Analysis.....		6
IV.	4.	Railroad Surveying	2	4
V.	1.	Mineralogy	3	3
V.	3.	General Geology	3	
III.	4.	Quantitative Analysis	1	9

MINING ENGINEERING.

As one of the chief purposes of the School is to prepare men to become designers of mining plants and supervisors of mining operations, the strictly business careers of the profession is kept constantly before the student. Valuing property, properly reporting propositions submitted for investment, calculating the factors in the economical operation of a plant and suggesting the best methods of developing a property, are considerations which receive careful treatment and are given prominence during the latter part of the curriculum.

Especially are the similarities and departures between the operations and requirements of metal-mining and coal-mining brought out. Placer and hydraulic mining and dredging, and the recent adaptation of the steam shovel and stripping methods to western metal mines are treated at considerable length.

Another important feature which is continually being more and more considered in mining operations is the geology of mineral deposits, and this subject receives detailed consideration.

FIRST AND SECOND YEARS.

See pages 17 and 18.

THIRD YEAR.

Course Numbers	Courses.	Periods per week	
		Class	Lab'y
First Semester			
II. 4.	Mechanics	3	
III. 5.	Advanced Quantitative Analysis.....		6
IV. 5.	Strength of Materials.....	2	
V. 7.	Petrology	2	3
III. 7.	Electro-Analysis		3
VI. 1.	Mining A.	3	
VII. 2.	Principles of Metallurgy.....	3	
VIII. 4.	Machine Drawing		6
IV. 11.	Hydraulics	3	
Second Semester			
II. 4.	Mechanics	4	
V. 4.	Field Geology	1	3
V. 7.	Petrology	2	3
III. 6.	Water and Fuel Analysis.....		9
VI. 2.	Mining B.	3	
VII. 6.	Metallurgy of Iron and Steel.....	2	
VII. 1.	Fire Assaying	1	8
VIII. 5.	Machine Design	2	6
VIII. 8.	Boilers	3	

FOURTH YEAR.

Course Numbers		Courses.	Periods per week	
			Class	Lab'y
First Semester				
II.	3.	Direct Currents	3	3
V.	5.	Economic Geology	3	
V.	3.	Mine Economics	2	
VI.	4.	Ore Dressing	3	6
VII.	5.	Metallurgy of Gold and Silver.....	3	8
VIII.	9.	Engines	3	
IV.	9.	Engineering Construction	2	
Second Semester				
V.	5.	Economic Geology	3	
VIII.	10.	Air Compression and Pumping.....	3	
VII.	9.	Metallurgical Laboratory	1	8
VI.	4.	Ore Dressing	2	3
VI.	7.	Design of Mine Plant.....		6
VI.	5.	Mine Administration and Accounts....	1	
VI.	6.	Examination of Mines.....	1	3
II.	6.	Alternating Currents	3	3

METALLURGICAL ENGINEERING.

The aim of this four years course is to train the student for a professional career in any branch of metallurgical work. Attention is given during the first two years to such fundamental subjects as mathematics, chemistry, physics, geology, mineralogy, and preliminary courses in engineering. Instruction in metallurgy proper begins in the third year, both lectures and laboratory experiments being employed for the purpose. Chemistry and geology are provided for, also. The work of the fourth year is along the line of advanced courses in metallurgy; especial attention being given to laboratory experiments, high temperature conditions of metallurgy, training in execution and interpretation of results. Such higher branches of engineering, chemistry, and courses of importance in mining engineering claim a considerable share of attention.

The course has been chosen with special reference to giving the student in metallurgical engineering a general knowledge of modern metallurgy as a whole, and a special knowledge of the metallurgy of each of the the more important metals.

FIRST AND SECOND YEARS.

See Pages 17 and 18.

THIRD YEAR.

Course Numbers	Courses.	Periods per week	
		Class	Lab'y
First Semester			
II. 4.	Mechanics	3	
III. 5.	Advance Quantitative Analysis.....		6
IV. 11.	Hydraulics4.....	3	
V. 7.	Petrology	2	3
VIII. 4.	Machine Drawing		6
VI. 1.	Mining A.	3	
VII. 2.	Principles of Metallurgy.....	3	
III. 7.	Electro-Analysis		3
II. 7.	Thermo-dynamics	3	
Second Semester			
II. 4.	Mechanics	4	
V. 7.	Petrology	2	3
III. 6.	Water and Fuel Analysis.....		9
VII. 1.	Fire Assaying	1	8
VII. 6.	Metallurgy of Iron and Steel.....	2	
VIII. 5.	Machine Design	2	6
VIII. 8.	Boilers	3	

FOURTH YEAR.

Course Numbers	Courses.	Periods per week	
		Class	Lab'y
First Semester			
II. 3.	Direct Currents	3	3
VI. 4.	Ore Dressing	3	6
VII. 5.	Metallurgy of Gold and Silver.....	3	3
VII. 4.	Metallurgy of Copper and Lead.....	2	3
VII. 8.	Metallurgical Plant and Design.....	1	6
VII. 7.	Metallurgical Calculations	1	
VIII. 9.	Engines	3	
Second Semester			
II. 6.	Alternating Currents	3	3
VI. 4.	Ore Dressing	2	3
VI. 5.	Mine Administration and Accounts....	1	
VII. 3.	Metallurgy of Zinc etc.	3	3
VII. 11.	Furnaces	3	
VII. 8.	Metallurgical Plant and Design.....		6
VII. 9.	Metallurgical Laboratory	1	8
VII. 10.	Metallurgy of Gold and Silver.....	1	3

GEOLOGICAL ENGINEERING.

This course extending over a period of four years is intended primarily to train men to examine, report and direct the future development of mines. In the first two years the course prescribed is similar to that of the Mining Engineering Department, so that students have a thorough training in fundamental subjects, especially in mathematics, chemistry, surveying, and other preliminary courses in engineering. In the second and third years the attention of the student is directed largely to geological subjects related closely to mining, namely: topographical surveying, geological surveying, petrology, and economic geology, while still continuing his studies in chemistry, mining, metallurgy, etc. The fourth year is devoted largely to advanced work in mining geology, visiting and reporting in detail on geological problems connected with ore deposition in various mining fields. Attention is also paid to the geological occurrence of petroleum.

FIRST AND SECOND YEARS.

See Pages 17 and 18.

THIRD YEAR.

Course Numbers	Courses.	Periods per week	
		Class	Lab'y
First Semester			
II. 4.	Mechanics	3	
III. 5.	Advanced Quantitative Analysis.....		6
IV. 11.	Hydraulics	3	
V. 7.	Petrology	2	6
VIII. 4.	Machine Drawing		6
VI. 1.	Mining A.	3	
VII. 2.	Principles of Metallurgy.....	3	2
Second Semester			
II. 4.	Mechanics	4	
V. 7.	Petrology	2	6
VI. 2.	Mining B.	3	
VII. 7.	Metallurgy of Iron and Steel.....	2	
VII. 1.	Assaying	1	8
III. 6.	Water and Fuel Analysis.....		6
V. 4.	Field Geology	1	8

FOURTH YEAR.

Course Numbers		Courses. First Semester	Periods per week	
			Class	Lab'y
II. 3.		Direct Currents	3	3
V. 5.		Economic Geology	3	3
V. 9.		Ore Genesis		6
VI. 3.		Mine Economics	2	
VI. 4.		Ore Dressing	3	6
VI. 7.		Design of Mine Plant.....		3
VII. 4.		Metallurgy of Copper and Lead.....	2	3
VII. 6.		Metallurgy of Gold and Silver.....	3	3
		Second Semester		
V. 6.		Economic Geology	3	3
V. 8.		Geological Examination and Surveys..	2	
V. 10.		Paleontology	2	6
VII. 4.		Metallurgy of Lead and Zinc.....	3	3
V. 11.		Special Problems		5
VIII. 10.		Air Compression and Pumping.....	3	
VI. 5.		Mine Administration and Accounts....	1	
VI. 6.		Examination of Mines.....	1	3
VI. 7.		Design of Mine Plant.....		6
II. 6.		Alternating Currents	3	3

CIVIL ENGINEERING.

This department provides a course of study in the theory and application of the principles of civil engineering. The first two years of work are the same as in the other engineering courses, including practical work in drafting room and field, as well as instruction in the fundamental principles of mathematics and physics. In the third year the studies relate more directly to civil engineering. Technical courses cover the principles of structural and machine design, power and power transmission, and other fundamental engineering processes. In the drafting room the student applies those principles to the design of machines, and the bridge and roof trusses. Sufficient field work is given to make the student thoroughly familiar with surveying instruments, and their use in road, mine, and railroad surveys. The proper care and adjustment of surveying and engineering instruments are made prominent in the training of the civil engineer.

FIRST AND SECOND YEARS.

See pages 17 and 18.

THIRD YEAR.

Course Numbers	Courses.	Periods per week	
		Class	Lab'y
First Semester			
VIII. 4.	Machine Drawing		6
II. 4.	Mechanics	3	
VII. 2.	Principles of Metallurgy.....	3	
IV. 10.	Roads and Pavements.....	3	
V. 7.	Petrology	2	3
IV. 11.	Hydraulics	3	
-IV. 5.	Strength of Materials.....	2	
II. 7.	Thermodynamics	3	
Second Semester			
II. 4.	Mechanics	4	
IV. 12.	Municipal and Sanitary Engineering..	3	
IV. 6.	Theory of Structures.....	3	2
V. 7.	Petrology	2	3
VIII. 5.	Machine Design	2	6
VIII. 8.	Boilers	3	
III. 6.	Water and Fuel Analysis.....		9
VII. 6.	Metallurgy of Iron and Steel.....	2	

FOURTH YEAR.

Course Numbers	Courses.	Periods per week	
		Class	Lab'y
	First Semester		
II. 3.	Direct Currents	3	3
IV. 15.	Contracts and Specifications.....	2	
IV. 7.	Structural Design	3	3
VIII. 7.	Heating and Ventilating.....	3	
IV.	Elective	3	
IV. 16.	Cost Keeping and Management.....	2	
VIII. 9.	Engines	3	
IV. 9.	Engineering Construction	2	
	Second Semester		
II. 6.	Alternating Currents	3	3
IV. 13.	Water Supply Engineering.....	2	
IV. 14.	Irrigation and Drainage.....	3	
IV. 8.	Reinforced Concrete	3	
IV. 7.	Structural Design		3
VIII. 10.	Air Compression and Pumping.....	3	
IV.	Elective	3	

CLASS SCHEDULE—FIRST SEMESTER.

Period	Yr.	MON.	TUES.	WED.	THURS.	FRI.	SAT.
8:00	1	Math. 2	Math. 2	Math. 2	Math. 2	Math. 2	Min. 4*
to	2	Math. 4	Math. 4	Math. 4	Math. 4	Math. 4	Phy. 1
8:50	3	Met. 2		Met. 2		Met. 2	
	4	C. E. 16		C. E. 16			
8:50	1	Math. 3		Math. 3		Math. 3	
to	2	C. E. 3	Phy. 1	Chem. 3	Phy. 1	C. E. 3	C. E. 3*
9:40	3	Min. 1	C. E. 5	Min. 1	C. E. 5	Min. 1	Phy. 7
	4	Geo. 5	Min. 3	Geo. 5	Min. 3	Geo. 5	
9:40	1						
to	2	Geo. 2	Geol. 2	Geol. 2	Geol. 2		
10:30	3	Phy 4	Phy. 7	Phy. 4	Phy. 7	Phy. 4	Phy. 3
	4	C. E. 7	C. E. 9	C. E. 7	C. E. 9	C. E. 7	
	4	Met. 5	Met. 4	Met. 5	Met. 4	Met. 5	
10:30	1	Math. 1	Math. 1	Math. 1	Math. 1	Math. 1	
to	2	Geo. 1	Chem. 8	Geol. 1	Chem. 8	Geol. 1	
11:20	3	C. E. 11	Geol. 7	C. E. 11	Geol. 7	C. E. 11	
	4	Min. 4	Met. 8	Min. 4	Met. 8	Min. 4	
	4	Mech. 7	C. E. 15	Mech. 7	C. E. 15	Mech. 7	
11:20	1	Chem. 1	Chem. 1	Chem. 1	Chem. 1	Chem. 1	
to	2		C. E. 2		C. E. 2		
12:10	3	C. E. 10	Phy 3	C. E. 10	Phy 3	C. E. 10	
	4	Mech. 9		Mech. 9		Mech. 9	
2:00	1	Chem. 1	Mech. 3	Chem. 1	Mech. 3	Mech. 2	
to	2	Chem. 3	Phy. 1	Chem. 3	Geol. 1	Chem. 3	
5:00	3	Mech. 4	Geol. 7	Mech. 4	Chem. 5	Chem. 5	
	4	Phy. 3		C. E. 7	Min. 7	C. E. 7	

*Indicates all day period.

C. E. 3 will run alternate Saturdays with C. E. 2,

CLASS SCHEDULE—SECOND SEMESTER.

Period	Yr.	MON.	TUES.	WED.	THURS.	FRI.	SAT.
8:00 to 8:50	1		Math. 2		Math. 2		Mech. 3†
	2	Math. 5	Math. 5	Math. 5	Math. 5	Math. 5	
	3	Mech. 5		Mech. 5			Met. 1*
	4	C. E. 14	Met. 9	C. E. 14		C. E. 14	Met. 9*
	4					Met. 10	Phy. 6
8:50 to 9:40	1	Mech. 6	C. E. 1	Mech. 6	C. E. 1	Mech. 6	
	2	Phy. 2		Phy 2		Phy 2	C. E. 4*
	3	Min. 2		Min. 2		Min. 3	
	4	Geol. 6	Phy. 6	Geol. 6	Phy. 6	Geol. 6	
	4	C. E. 7	Min. 4	C. E. 7	Min. 4	C. E. 7	
9:40 to 10:30	1		Chem. 2		Chem. 2	Math. 3	
	2	Geol. 1	Geol. 2	Geol. 1	Geol. 2	Geol. 1	
	3	Phy. 4	Phy. 4	Phy. 4	Phy. 4	Met. 1	
	4	Mech. 10	C. E. 13	Mech. 10	C. E. 13	Mech. 10	
	4	Met. 9	Min. 5	Met. 9			
10:30 to 11:20	1	Math. 1	Math. 3	Math. 1	Math. 3	Math. 1	
	2					Chem. 4	
	3	Mech. 8		Mech. 8		Mech. 8	
	3	C. E. 12	Geol. 7	C. E. 12	Geol. 7	C. E. 12	
	4	Met. 3	Min. 6	Met. 3	Min. 6		
11:20 to 12:10	1	Chem. 1	Chem. 1	Chem. 1	Chem. 1	Chem. 1	
	2		C. E. 4		C. E. 4		
	3	C. E. 6		C. E. 6		C. E. 6	
	4	Met. 11	Met. 6	Met. 11	Met. 6	Met. 11	
2:00 to 5:00	1	Chem. 2	C. E. 1	Chem. 2	C. E. 1	Chem. 2	
	2	Chem. 4	Phy. 2	Chem. 4	Geol. 1	Chem. 4	
	3	Chem. 6	Mech. 5	Chem. 6	Mech. 5	Chem. 6	
	3			Geol. 7			
	4	C. E. 8		C. E. 8	Phy 6	C. E. 8	
	4	Met. 8		Met. 8			

*Indicates all day period.

†Indicates half day period.

DEPARTMENT OF INSTRUCTION

I. DEPARTMENT OF MATHEMATICS

DOCTOR MACKEY.

The study of mathematics is emphasized as a necessary basis for the further instruction in the engineering subjects. The courses have been arranged to meet the extensive needs of students in the various branches of engineering and are intended to develop power of deduction as well as to familiarize the student with the various methods of calculation used in practical problems. Students are encouraged to use logarithms and the slide rule when the latter can be employed without too great loss of accuracy. They will also be introduced to various books of tables that facilitate calculation.

1. Advanced Algebra.

The work begins with a review of elementary algebra. This is followed by the solution of simple and quadratic equations with a large number of practical problems, the summation of arithmetical and geometrical progressions, graphical solutions of equations, vector quantities, variation and proportion, partial fractions logarithms, inequalities, probabilities, abridged methods of calculation, slide rule, and limits of error.

Prerequisite: *Elementary Algebra*.

Time: Class-room, five periods a week, first semester; three periods a week, second semester.

Text: Hawkes, *Advanced Algebra*.

2. Trigonometry.

A thorough knowledge of the subject matter of this course is essential for the successful carrying out of general surveying, topographical surveying, and mine surveying. It deals with the measurement of angles; the relations among the sine, cosine, and tangent of an angle; the values of the functions of multiple and fractional angles; the solution of simple trigonometric equations; the solution of right and oblique triangles, involving logarithmic calculations with tables and very many practical problems; the simplest elements of spherical trigonometry. The last mentioned subject is necessary for an understanding of the methods

of determining latitude and longitude, and also is essential for geodetic surveying.

Prerequisite: Elementary Algebra and Plane and Solid Geometry.

Time: Class-room, five periods a week, first semester; two periods a week, second semester.

Text: Murray, *Plane and Spherical Trigonometry with Tables*.

3. Analytic Geometry.

This subject combines the methods used in algebra and in geometry, and employs them in the study of simple curves, surfaces, and solids. It therefore affords a good introduction to mechanical drawing, mapping, surveying, and mensuration. It deals with plotting with different systems of coordinates, estimation of areas, properties of systems of straight lines, circles, the parabola, the ellipse, the hyperbola, changes produced in maps by change of origin and rotation of axes, simple curves in three dimensions, surface areas and volumes of simple solids.

Prerequisites: Courses 1 and 2 of this department must accompany or precede this course.

Time: Class-room, three periods a week, first semester; two periods a week, second semester.

Text: Smith and Gale, *New Analytic Geometry*.

4. Differential Calculus.

This subject is of great importance in the study of curves, of rates of variation, of maximum and minimum values; and is indispensable for the reading of most text-books of science, especially as applied in textbooks on engineering. It includes limits, curve tracing and other applications of the derivative, maxima and minima, radii of curvature, summation of series, partial differentiation, and the solution of many problems in least cost and maximum efficiency.

Prerequisites: Courses 1, 2 and 3 of this department.

Time: Class-room, five periods a week, first semester.

Text: Murray, *Differential and Integral Calculus*.

5. Integral Calculus.

The integral calculus is the most powerful weapon of calcu-

lation. It is applied in this course to the calculation of lengths of curves, areas of surface, volumes of solids, moments of inertia, centers of gravity, work performed by bodies moving against given forces, and in many other applications to mechanics, heat, electricity and magnetism, and mensuration.

Prerequisites: Courses 1, 2, 3 and 4 of this department.

Time: Class-room, five periods a week, second semester.

Text: Murray, *Differential and Integral Calculus*.

SPECIAL AND GRADUATE COURSES IN MATHEMATICS.

Students having time and interest for the study of mathematics beyond the prescribed limits are offered opportunity for more advanced work. The Department will also endeavor in particular to meet the needs of graduate students desiring to engage in mathematical investigation of problems of engineering or applied science. The idea that an engineer should be a practical rather than a theoretical mathematician has guided the selection of elective and graduate courses. Students who wish to take optional work should arrange at the beginning of the college year with the head of the department of mathematics.

In addition to the foregoing, which are required of all students of engineering, the following elective and graduate courses are offered.

6. Integrals of Mechanics.

Certain types of integrals which are met with great frequency in the study of mechanics, are treated. These integrals, namely, the inertia integrals, those defining mass, and moment and center of mass, are essential in the discussion of the motion and the conditions of equilibrium of systems of particles and rigid bodies. Other integrals are studied, involving applications of mechanics to work, attraction, pressure, and centers of gravity and pressure.

Text: Lester, *The Integrals of Mechanics*.

7. Applications of the Calculus to Mechanics.

Wherever the teaching of mathematics to engineering students is discussed, and frequently in cases of other classes of students, the criticism which is almost without exception the most insistent is this: that the student leaves the course without adequate

ability to apply his mathematical knowledge. This means that he has not the faculty of taking a problem, giving it an analytic formulation, and interpreting the analytic results. This course is intended to supply the needed training. Students should obtain a comprehensive view of this course, partly because of the value of such a course as a means of general mental development, partly because new practical applications of discoveries in engineering are continually being made, and because no one can predict what particular facts or principles are most likely to find important practical applications in the future.

Text: Hedrick & Kellogg, *Applications of the Calculus to Mechanics*.

8. Differential Equations.

In many colleges of engineering, the need is felt for a course treating the subject of Differential Equations, limited in scope, yet comprehensive enough to furnish the student of engineering with sufficient information to enable him to deal intelligently with any differential equation which he is likely to encounter. To meet this need is the object of this course. Numerous applications to problems in Geometry, Physiscal Sciences, and Engineering are introduced.

Text: Cohen, *An Elementary Treatise on Differential Equations*.

II. DEPARTMENT OF PHYSICS

DOCTOR MACKEY.

The courses in physics outlined below serve to introduce students to accurate measurements identical with or similar to those which he will have to perform frequently as an engineer. In general, the experiments carried out in these courses help him to understand the physical bases for the varied methods of procedure in engineering processes. The apparatus for the course in experimental mechanics is of a very substantial character. This apparatus is well adapted for illustrating principles that lie at the foundation of an engineer's work. As in the other courses in this department, the laboratory work is accompanied by lecture room discussions and by the working out of illustrative problems. The course in heat forms an introduction to metallurgical processes especially. The course in light is introductory to much of the succeeding work in mineralogy and petrography. The elementary course in electricity and magnetism is devised for students of all branches of engineering, especial attention being paid to electrolysis and to the methods of action of simple electrical machines. The student is here introduced to the measurement and calculation of the principal electrical quantities that are met with in common engineering practice. The succeeding courses in electricity and magnetism are intended to give an opportunity for a deeper study of these subjects, and are intended especially for students who wish to specialize in electrical engineering, or in electrical machinery for mine plants, etc.

1. Experimental Mechanics.

The class work consists of lectures, demonstrations, recitations and the solution of assigned problems.

The laboratory work is so arranged as to exemplify the principles discussed in class and is quantitative in character, the qualitative experiments being performed in the class-room. The laboratory work consists of the following experiments: (1) Uniformly accelerated motion; (2) Relation of force to mass and to acceleration; (3) Composition and resolution of forces; (4)

Moments; (5) Energy and efficiency; (6) Inelastic impact; (7) Elastic impact; (8) Young's modulus; (9) Moments of torsion and coefficient of rigidity; (10) Moment of inertia; (11) Simple harmonic motion; (12) Measurement of gravitation constant; (13) Centripetal force; and a few other exercises if time permits.

Prerequisites: Courses 1, 2 and 3 of Department I.

Time: Class-room, three periods a week, first semester.

Laboratory, three periods a week, first semester.

Text: Millikan, *Mechanics, Molecular Physics and Heat*.

Duff, *A textbook of Physics*.

2. Heat and Light.

The first part of this course will deal with temperature, expansion, thermal conductivity, radiation, convection, change of state, calorimetry, with simple applications to furnaces, ventilation, and heat engines. The second part of the course will deal with the laws of reflection and refraction of light, combinations of lenses, eye-pieces and objectives of microscopes, prisms, double refraction, the spectrometer, polarized light and photometry.

Prerequisite: Course 1 of this department.

Time: Class-room, three periods a week, second semester.

Laboratory, three periods a week, second semester.

Text: Duff, *A Textbook of Physics*.

Millikan and Mills, *Electricity, Sound and Light*.

Millikan, *Molecular Physics and Heat*.

3. Direct Currents.

Discussions and laboratory work on electric circuits and resistance, magnetic circuits, electromagnets, direct-current generators and motors; starters and controllers, practical operation of direct current machines, storage batteries, etc.

Prerequisites Courses 1 and 2 of this department.

Time: Class-room, three periods a week, first semester.

Laboratory, three periods a week, first semester.

Text: Duff, *A Textbook of Physics*.

Millikan and Mills, *Electricity*.

Gray, *Principles and Practice of Electrical Engineering*.

4. Mechanics.

The principal topics taken up are force, combinations of forces, center of gravity, moment of inertia, gravitation, stress, numerous cases of equilibrium, cords, jointed frames, friction, velocity and acceleration, harmonic motion, translation, rotation, work, energy, impulse, momentum, and very many simple practical problems with different forms of structures and machines.

Prerequisites: Courses 2, 3, 4, and 5 of Department I and Course 1 of this department.

Time: Class-room, three periods a week, first semester; and four periods a week, second semester.

Text: Maurer, *Technical Mechanics*.

Sanborn, *Mechanics Problems*.

5. Electromagnetism.

A discussion of the fundamental equations of electricity and magnetism; and calculation of field intensities, resistances, capacities, self and mutual induction, etc.

Prerequisites: Courses 4 and 5 of Department I and Course 3 of this department.

Time: Class-room, three periods a week, second semester.

Text: Poynting and Thomson, *Electricity and Magnetism*.

6. Alternating Currents.

Discussions and laboratory work on inductive circuits, capacity circuits, alternators, synchronous motors, transformers, induction motors, transmission and distribution, practical operation of machines, etc.

Prerequisites: Courses 1, 2 and 3 of this department.

Time: Class-room, three periods a week, second semester.

Laboratory, three periods a week, second semester.

Text: Duff, *A Textbook of Physics*.

Gray, *Principles and Practice of Electrical Engineering*.

7. Thermodynamics.

The application of the laws of heat and mechanics to the steam engine, internal combustion engines, refrigerators, compression and pumping machinery.

Prerequisites: Courses 1 and 2 of this department.

Time: Class-room, three periods a week, first semester.

Text: Cardullo's *Practical Thermodynamics*.

III. DEPARTMENT OF CHEMISTRY

PROFESSOR ILLINSKI.

The excellent equipment of the chemical laboratory (elsewhere described) makes it possible to offer a number of advanced courses essential to chemical engineering, in addition to those required by the curricula already outlined. These courses are designated *special* and will be given upon the request of a sufficient number of students.

1. General Chemistry.

This course is introductory to the engineering courses and is required of all students. It comprises five lectures and two laboratory periods per week. The fundamental principles of the science are taught in connection with the descriptive chemistry of the various elements. The lectures are designed to precede the work of the laboratory, in which the student is expected to illustrate and verify the facts and principles which have been discussed in the lecture room. Careful manipulation, thoroughness in observation, accuracy in arriving at conclusions, and neatness in note-taking are required of each student.

No previous study of chemistry is required for admission to this course, but the instruction is so arranged that students who have already spent considerable time upon chemical work in the secondary schools are admitted to work of a somewhat advanced character, in which the knowledge which they have already acquired is utilized.

Prerequisite: Entrance requirements.

Time: Class-room, five periods per week, first and second semesters.

Laboratory, six periods per week, first semester.

Text: Smith, *General Chemistry for Colleges*.

Smith, *A Laboratory Outline of General Chemistry*.

2. Qualitative Analysis.

This course includes class-room instruction, laboratory practice, and individual conference with instructors in the laboratory. The student is required to analyze alloys, minerals, rocks, pigments, slags, mattes, and industrial products of various sorts

and complexity. An effort is made to avoid mere thoughtless mechanical laboratory work on the part of the student and to give him an insight into the chemical principles involved in the process studied.

Prerequisites: Chemistry 1.

Required of all students.

Time: Class-room, two periods per week, second semester.

Laboratory, nine periods per week, second semester.

Text: A. A. Noyes, *Qualitative Analysis*.

Treadwell and Hall, *Analytical Chemistry*, Vol. I.

3. Quantitative Analysis.

A course embodying the general principles of quantitative analysis and introductory to those involving special quantitative methods. In the laboratory the following experiments are performed: The gravimetric determination of chlorine in a soluble chloride; water of crystallization in copper sulphate; iron and sulphur in ferrous sulphate; carbon dioxide; calcium and magnesium in dolomite; alumina in an alum; closing with a complete analysis (technical) of a clay.

Prerequisite: Chemistry 1 and 2.

Required of all students.

Time: Class-room, one period per week, first semester.

Laboratory, nine periods per week, first semester.

Text: Moody, *Quantitative Analysis*.

4. Quantitative Analysis.

A thoroughly practical course, largely volumetric, in the determination of the important constituents of ores and metallurgical products. The methods taught are those in use in the large smelters of the West. The student works upon checked samples of widely varying composition until he becomes familiar with the various methods and can carry them out under all conditions with accuracy and rapidity.

Each student is required to analyze two or more ores for each of the following: Iron, copper, zinc, lead, phosphorus, calcium, manganese, sulphur and arsenic. The essential parts of the course are speed tests, in which the students are required to report correct results on a number of copper, zinc and lead ores

within a stated time, thus gaining a little of the speed and accuracy necessary to every practical assayer.

Prerequisite: Chemistry 3.

Required in all courses.

Time: Class-room, one period per week, second semester.

Laboratory, nine periods per week, second semester.

Text: Low, *Technical Methods of Ore Analysis*.

Seamon, *Manual for Assayers and Chemists*.

5. Advanced Quantitative Analysis.

This course is the extension of Course 4, and the work will be chosen to suit the need of each student. It may consist of the analysis of rocks and minerals, speisses, crude and refined lead and copper bullion, spelter, iron and steel, cement, or the determination of some of the rare elements.

Prerequisite: Chemistry 4.

Required in Mining, Metallurgy, and Geology.

Time: Laboratory, six periods per week, first semester, Junior year.

6. Water and Fuel Analysis.

This course is designed to meet the wants of engineering students. Analyses of water are made in regard to their possible use in boilers. These analyses involve the determination of total solids, organic and volatile matter, silica, iron and alumina, calcium, magnesium, sodium, and potassium and carbonic, sulphuric and hydrochloric acids.

Prerequisite: Chemistry 3.

Required in all courses.

Time: Laboratory, six periods per week, second semester, Junior year.

Text: Stillman, *Engineering Chemistry*.

Treadwell & Hall, *Analytical Chemistry, Vol. II*.

Analysis of various coals and other fuels are made, their heat values calculated from these analyses and also determined by means of a calorimeter. Flue gases are analyzed and the results interpreted. The flash-point, burning point, specific gravity, viscosity and acidity of oils are determined.

Prerequisite: Chemistry 3.

Required in all courses.

Time: Laboratory, three periods per week, second semester,
Junior year.

Text: Stillman, *Engineering Chemistry*.
Hemple, *Gas Analysis*.

7. Electro-Analysis.

This course will deal with the practical application of the electric current in determining some of the common metals such as copper, silver, lead and zinc. After the student has become familiar with the methods used for determining each of these, he will use the current in separating mixtures of metals and as a rapid, accurate method of ore analysis.

Prerequisite: Chemistry 4.

Required in Mining and Metallurgy.

Time: Laboratory, three periods per week, first semester,
Junior year.

Text: Edgar F. Smith, *Electro Analysis*.

8. Physical and Theoretical Chemistry.

The elements of theoretical chemistry have already been studied in the course in general chemistry, qualitative and quantitative analysis. The subject is here pursued more exhaustively. The principal subjects considered are: The gas laws, atomic and molecular weights and the methods of determining them, forms and the phase rule, kinetic theory, thermo-chemistry, ionization, dissociation and balanced actions and electro-chemistry.

Prerequisite: Chemistry 2.

Required in all courses.

Time: Class-room, two periods per week, first semester.

Text: Walker, *Introduction to Physical Chemistry*.

9. Inorganic Preparations (Special).

Chemically pure substances of commercial importance are prepared by the student with constant attention to the securing of maximum yield. Skill in manipulation is encouraged, methods of manipulation not occurring in other courses are practiced, and a general increased knowledge of inorganic chemistry is acquired.

Prerequisite: Chemistry 2.

Time: Class-room, one period per week, one semester.

Laboratory, six periods per week, one semester.

10. Industrial Inorganic Chemistry (Special).

The utilization of inorganic materials in manufacturing processes was taken up in an elementary way in connection with general chemistry. This special industrial course goes into the subject considerably more in detail. The manufacturing processes considered are mainly those of acids, alkalis, mineral dyes, mineral paints, explosives and matches.

The aim is to expound the dominant principles underlying each process rather than to present such an account of the details as will suffice for the student of any particular industry. In this manner, the student is prepared to study efficiently the literature of any branch in which he may afterwards become especially interested.

Prerequisites: Chemistry 1 and 2.

Time: Class-room, two periods per week, one semester.

Text: Rogers & Auberts, *Industrial Chemistry*.

11. Organic Chemistry (Special).

This course serves as an introduction to the study of the hydrocarbons of both the fatty and aromatic series, alcohols, phenols, aldehydes, organic acids, ethers, esters and carbohydrates. Their formation, relations and derivatives are discussed, and special attention is given to the explanation of familiar organic phenomena.

Prerequisites: Chemistry 1 and 2.

Time: Class-room, two periods per week, one semester.

Laboratory, six periods per week, one semester.

Text: Cohen, *Theoretical Organic Chemistry*.

Gatterman, *Practical Methods of Organic Chemistry*.

IV. DEPARTMENT OF CIVIL ENGINEERING

PROFESSOR WHITE.

In Civil Engineering, the first three years are devoted to the mastery of those sciences upon which all professional engineering practice is based. In addition to a thorough mathematical training, particular care is taken to familiarize the student with the construction, care and use of engineering instruments. To this end, in addition to the regular class-room work, much time is given to field work, wherein a great variety of practical problems are treated. Especial attention is also given to the study of engineering materials and their adaptation to road building and street paving.

In the work of the fourth year the student is given instruction in Structural Design and Water Supply Engineering. The work, which is largely drawing and design, covers practical problems, with the intent that the student may become thoroughly familiar with the principles governing his profession and with their application.

The School offers great advantages in the line of Drainage and Irrigation Engineering. Besides being situated in a distinctly irrigation country, it is also in reasonable proximity to two of the largest irrigation projects of the United States Reclamation Service, where the latest and best methods may be studied. The Elephant Butte dam is about sixty miles south of Socorro and forms the largest artificial body of water in the world.

Students have usually been able to attach themselves during the summer vacation to the regular surveying parties of railway, irrigation or mining companies.

1. General Surveying.

The introductory course in surveying deals with the principles of land measurement, and with the instruments used in both field and office.

Treats of the use of steel tape, level and transit. The fundamentals of surveying such as measurement of lines, angles, and differences in elevation. Land surveying: areas and plotting.

This course covers field work, recitations, computation and mapping.

Prerequisites: Courses 1 and 2, Department I.

Time: Class-room, two periods a week, second semester.

Field work, four periods a week, second semester.

Text: Breed and Hosmer, *Theory and Practice of Surveying*.

2. Topographical Surveying.

This course deals with use of transit and plane table in topographic surveying. Stadia and other methods used in locating topographical features. Use of triangulation and base lines also considered. A complete survey will be made and plotted.

Prerequisite: Course 1 of this department.

Time: Class-room, two periods a week, first semester.

Field work, four periods a week, first semester.

Text: Breed and Hosmer, *Theory and Practice of Surveying*.

3. Mine Surveying and Mapping.

Work consists of field practice, recitation and drafting room exercises.

Feld surveys of mining claims and underground workings are made. Mapping is done in drafting room from field notes.

Prerequisite: Course 1 of this department.

Time: Class-room, two periods a week, first semester.

Field work, four periods a week, first semester.

Text: To be determined later.

4. Railroad Surveying.

Work consists in the study of railway curves, transitions, turn-outs, earthworks and field work of location. Railway location and mapping carried on in connection with field work.

Prerequisites: Courses 1 and 2 of this department.

Time: Class-room, two periods a week, second semester.

Field work, four periods a week, second semester.

Text: Allen's *Railway Curves*.

5. Strength of Materials.

Is a study of the stresses and deformation of bodies subjected to tension, to compression, to shearing, to torsion; the study of elasticity of bodies; stresses in and design of pipes, riveted joints and hooks. Treats of the theory of beams with discus-

sion of bending moments, shearing forces and distribution of stress.

Prerequisite: Course 4, Department II.

Time: Class-room, two periods a week, first semester.

Text: Boyd, *Strength of Materials*.

6. Theory of Structures.

This course is devoted to the study of loads, reactions, shears, moments, by analytical and graphical methods. Analysis of roof trusses and plate girders with design of same.

Prerequisites: Course 5 of this department and Course 2, Department II.

Time: Class-room, three periods a week, second semester.

Laboratory, four periods a week, second semester.

Text: To be determined later.

7. Structural Design.

A course in which each student is given a different set of data and is required to make computations, designs and working drawings of several structures, such as a roof truss, plate girder and a riveted or pin connected bridge.

Prerequisites: Courses 5 and 6 of this department.

Time: Class-room, three periods a week, first semester.

Laboratory, three periods a week, first and second semesters.

Text: Same as for Course 6 of this department.

8. Reinforced Concrete.

This is a design course covering beams, girders, columns, etc. A design of a concrete building, including forms, is required of each student taking this course.

Prerequisites: Courses 5 and 6 of this department.

Time: Three periods a week, second semester.

Text: Hool, *Reinforced Concrete, Volume I*.

9. Engineering Construction.

In this course the attention of the student is directed toward the various building materials, foundations, piles and pile driving, culverts, retaining walls, etc. Problems are given for solution and work of staking out structures.

Prerequisites: Course 5 of this department and Course 4 of Department II.

Time: Class-room, two periods a week, first semester.

Text: Baker, *Treatise on Masonry Construction*.

10. Roads and Pavements.

Examination of the methods of construction of various kinds of roads and pavements; the treatment of road surfaces, and use of paving materials, as well as the economics of road building.

Prerequisites: Courses 1 and 4 of this department.

Time: Class-room, three periods a week, first semester.

Text: To be determined later.

11. Hydraulics.

Study of fluid pressure, and laws governing the flow of water through orifices and pipes, over weirs, in closed conduits, and in open channels. The hydraulic laws relating to water wheels, etc., are briefly discussed.

Prerequisite: Course 4 of Department II.

Time: Class-room, three periods a week, first semester.

Text: Russell, *Textbook on Hydraulics*.

12. Municipal and Sanitary Engineering.

Study of quantity of house-sewage and storm water, and the shape and dimensions of pipes and conduits for carrying the same. The use of flush tanks, man-holes and the ventilating systems.

Prerequisite: Course 11 of this department.

Time: Class-room, two periods a week, second semester.

Text: Folwell, *Sewerage*.

13. Water Supply Engineering.

The design, construction and maintenance of municipal water supply systems, under the following divisions: Sources and requisites of water supply; methods of collecting, storage and distributing, etc.

Prerequisite: Course 11 of this department.

Time: Class-room, two periods a week, second semester.

Text: Turneaure and Maurer, *Public Water Supply*.

14. Irrigation and Drainage.

Design and construction of dams, reservoirs, flumes, canals,

etc. A system of problems to best show the uses of the above will also be given.

Prerequisites: Courses 9 and 11 of this department.

Time: Class-room, three periods a week, second semester.

Text: Wilson, *Manual of Irrigation Engineering*.

15. Contracts and Specifications.

Laws of contracts covering contracts, agency, torts, and independent contractor; contracts of sale, association, transportation, etc. Study of engineering contracts and specifications with problems in contract and specification writing.

Time: Class-room, two periods a week, first semester.

Text: Tucker, *Contracts in Engineering*.

16. Cost, Keeping and Management.

An elementary course on principles which govern the organization and management of labor on construction; systems of measurement, payment and efficient methods of cost keeping.

Time: Class-room, two periods a week, first semester.

Text: To be decided later.

In addition, special design courses may be arranged for in Steam or Electric Railway, Highway, Irrigation and Drainage Engineering.

V. DEPARTMENT OF GEOLOGICAL ENGINEERING

PROFESSOR ANDERSON.

This department aims to give its students knowledge concerning bodies of ores and their relations to geologic structure. It deals with that fundamental knowledge of minerals and conditions of ore deposition upon which the success of the operator so largely depends. It endeavors to give a training so that exploration and exploitation may be carried on, not only with accumulated knowledge, but also with more of the precision and certainty of scientific methods. In brief, its general aim is to promote an intelligent, systematic study of conditions, so that mining may become more and more a business and that the element of chance may be reduced to a minimum.

1. Mineralogy.

The first part of the course is devoted to a general study of crystallography, taking up the different crystal systems. This is followed by a study of the hardness, specific-gravity, cleavage, and other physical characteristics of minerals, rapid sight determination of unlabeled specimens being especially emphasized.

Blowpipe analysis is then taken up, observations being made in the laboratory of the behavior of minerals when heated in closed and open tubes and on charcoal. Sublimates characteristic of different elements are examined and recognized. Characteristic flame colorations are studied, and also colors imparted by oxides to microcosmic-salt and borax beads. A few wet tests for elements are also studied. The information thus acquired is then used in the Determinative Mineralogy which makes up the rest of the course.

Specimens of mineral from the large collections of the School and also those collected on field excursions or sent into the laboratory are examined and identified by the student, the crystal form, the physical and chemical properties and the paragenesis of each mineral being carefully studied. Special emphasis is given to acquiring familiarity with a large number of such min-

eral species as occur in mining regions and with the associations in which they are likely to be found. The order of study followed in the lectures is: The elements, sulphides, selenides, arsenides, tellurides, antimonides, sulphosalts, haloids, oxides, oxygen-salts, salts of the organic acids and hydrocarbons. Collateral reading is required on the important species.

Weekly quizzes, monthly reviews and other practical exercises supplement the daily lectures and serve to broaden the student's training, as well as to fix in his memory the various distinctions between mineral species. The relative values of each mineral, both from the standpoint of economic use and its worth for mineral collections, are clearly and fully set forth.

Prerequisite: Course 2 of Department III.

Time: Class-room, three periods a week, one year.

Text: Rogers, *Study of Minerals*.

Brush and Penfield, *Determinative Mineralogy and Blowpipe Analysis*.

2. General Geology.

All the training in geology is arranged with special reference to professional work. There are three main classes of students to which the courses have been particularly adapted. The first class embraces those whose occupations are to be closely identified with mining. A second class includes those who look forward to employment of a more or less public character, such as is afforded by private, state and federal geological surveys. A third class aims to embrace students who expects to follow in part, at least, the pure science of geology, or to be connected with the economic and technical departments of higher educational institutions.

The instruction is conducted by means of lectures, recitations, laboratory work in the rock collections, and in study and interpretation of topographic maps, and frequent excursions into the field. The processes and conditions of geology are considered in their different aspects. The laws and methods of interpretation of phenomena are discussed with considerable detail, training in the interpretation of geological phenomena being the object sought.

Features illustrating a large variety of geological phenomena

are well displayed in the neighborhood of the School and afford excellent opportunities for field-work. The old Socorro volcano, rising 2,500 feet above the campus, presents many types of rocks, and many structures associated with volcanic districts. Limitar mountain, ten miles away, affords other phenomena of vulcanism. Faulting, folding, jointing and other associated features, are well displayed. The sedimentaries are well represented from the paleozoics to the most recent. The phenomena of erosion and the development of geographic forms are almost unique. With all these illustrations at the very door of the School, the student is never at a loss for something interesting and new.

Excursions are made, mines are visited, and the student is instructed in the art of taking notes, and of making sketches and maps. He subsequently writes out a full but concise report of his observations, which is critically examined in all its aspects by the instructor in charge. These reports are then talked over in class, and the shortcomings noted and corrected.

Prerequisite: Course 1 of this department.

Time: Class-room, four periods a week, first semester.

Text: Chamberlain and Salisbury, *College Geology*.

Scott, *Introduction to Geology*.

3. General Geology.

Discussion of theories of earth genesis, the principles of stratigraphy, and the geologic history of the development of the North American continent, involving laboratory work with type fossils and rock collections.

Prerequisite: Course 2 of this department.

Time: Class-room, two periods a week, second semester.

Text: Chamberlain and Salisbury, *College Geology*.

4. Field Geology.

Each student is assigned a limited area within the Socorro Quadrangle. Instruction is given in the field in observing and recording geological phenomena and the preparation of maps and sections. The collections made are then studied in the laboratory and a complete report describing the geology of the area is required.

Prerequisites: Course 3 of Department IV and Courses 1, 2, and 3 of this department.

Time: Saturdays, first semester.

5. Economic Geology.

This course embraces the study of the theories of ore deposition and the general features and formation of ore bodies and classification of ore deposits. This is followed by a description of the deposits of the ores of iron, copper, lead, zinc, silver, gold, and the lesser metals, with special reference to North America.

Prerequisites: Courses 1, 2 and 3 of this department.

Time: Class-room, three periods a week, first semester.

Text: Lindgren, *Mineral Deposits and Lecture Notes*.

6. Economic Geology.

This course embraces the study of the non-metallic minerals of economic importance. A description of the distribution and occurrences of coal, petroleum, natural gas, asphalts, building stones, water supply, clays, cement rock, salt, gypsum, sulphur, fertilizers, abrasives, gems, and minor minerals.

Prerequisites: Courses 1, 2 and 3 of this department.

Time: Class-room, three periods a week, second semester.

Collateral readings and reports on assigned topics are required of students in Mining Geology.

Time: Laboratory, three periods a week, one year.

7. Petrology.

A discussion of the origin, mineralogical and chemical composition, field classification, and nomenclature, and microscopic structure of the crystalline, sedimentary, and metamorphic rocks. This is supplemented by field and laboratory work in the rock collections.

Prerequisites: Courses 1, 2 and 3 of this department.

Time: Class-room, two periods a week, one year.

Laboratory, three periods a week, one year, in all courses excepting geological course which is six periods a week.

Texts: Kemp, *Handbook of Rocks and Lecture Notes*.

Luquer, *Minerals in Rock Sections and Lecture Notes*.

Leith and Mead, *Metamorphic Geology*.

8. Geological Examinations and Surveys.

A discussion of the methods of systematically recording and interpreting geological phenomena, and the organization and scope of geological surveys. This is followed by a sketch of the history and results of state and national geological surveys in the United States, and of other sources of detailed information regarding local geology.

Prerequisites: Courses 1, 2, 3, 5 and 6 of this department.

Time: Class-room, two periods a week, second semester.

Lecture Notes.

9. Ore Genesis.

The study of the paragenesis and origin of the minerals of a certain ore deposit. The student makes a collection of the deposit which is then studied in the laboratory by means of microscopic slides and polished surfaces and microchemical tests, etc.

Prerequisites: Courses 1, 2, 3, 4, 5 and 6 of this department.

Time: Laboratory, six periods a week, first semester.

10. Paleontology.

A study of the invertebrate index fossils characteristic of the geologic horizons of North America.

Prerequisite: Course 3 of this department.

Time: Class-room, two periods a week, second semester.

Laboratory, six periods a week, second semester.

Text: Grabau and Shimer, *North American Index Fossils*.

11. Special Problems.

Research work in some branch of the science of geology, such as investigation in petrology, stratigraphy, paleontology, or ore deposits. This work may form the basis of a thesis in Geological Engineering.

Prerequisites: Courses 3, 5, 6 and 7 of this department.

Time: Laboratory, five periods a week, second semester.

VI. DEPARTMENT OF MINING ENGINEERING

PROFESSOR FAHRENWALD.

The instruction in mining is given by means of lectures illustrated by photographs and detailed drawings. Recitations are held on assigned topics, and field examinations are made. The latter enter largely into the more practical part of the work. The entire course is pre-eminently practical in character.

1. Mining, A.

The following subjects are studied:

Mineral deposits, their classification from a mining standpoint and their irregularities as affecting the work of exploration and mining.

Prospecting by panning, trenches, test pits, boring and drilling. Testing of placers and ore deposits with well or chain drills.

Excavation of earth; tools; methods; supports.

Excavation of rock; explosives, kinds, nature, manufacture and use; methods of drilling and blasting, mammoth blasts; quarrying.

Machine drills: Construction and operation.

Tunneling: Methods of driving and timbering; permanent linings; sizes, speeds of advance and costs.

Boring: Methods and appliances for small depths and for deep boring; the diamond drill; survey of bore holes.

Shaft-sinking: Methods and tools for both hard and soft material; sinking; lining; handling and hoisting of material; timbering, walling and tubing.

Methods of support: Pillars, timbers, filling.

Excursions are made to neighboring mines on Saturdays.

Prerequisites: Course 3 of Department I; Courses 1 and 2 of Department II; Course 1 of Department III.

Time: Class-room, three periods a week, first semester.

Text: Young, *Elements of Mining*.

Lecture Notes.

2. Mining, B.

The subjects studied are:

Surface-handling and transportation; arrangements for loading, unloading and storage of minerals; mineral railroads and common roads.

Ore extraction by systems of overhand and underhand stopping; caving by top slicing and sub-drifting; support of workings by filling and square-setting.

Underground haulage: Mine cars; arrangement of tracks; hand tramming; mule and rope haulage; gravity roads; steam, compressed air and electric locomotives.

Hoisting: Engines, drums, wire rope, skips and cages; head-frames; calculation of power required and methods of equalizing the load on the engine; devices for prevention of over-winding; shaft-sinking plant.

Arrangements at top and underground landings: Ore-pockets; signaling, etc.

Drainage: Buckets, tanks and head-pumps; Cornish and direct-acting underground pumps; operation of pumps by electricity, compressed air and hydraulic power.

Ventilation: Natural ventilation, underground furnaces, positive blowers and centrifugal fans; efficiency of fans.

Illumination: Candles; torches; lamps classified as oil, gasoline, magnesium, acetylene, electric and safety.

Accidents to men from fire-damp, dust explosions, mine-fires, falling material and inundations; prevention; rescue and relief.

Prerequisites: Same as for preceding course.

Time: Class-room, three periods a week, second semester.

Texts: Same as in Course 1.

3. Mine Economics.

Among the subjects studied are: Factors governing the value of a mine; relation of labor; selling price of products, and profits; amortization of capital; ore sorting and its relation to profit; comparative efficiency of mining methods, plants, etc.; balancing the cost of mining equipments against the saving effected to see whether or not the installation is advisable.

Prerequisite: Course 2 of this department.

Time: Class-room, two periods a week, first semester.

Text: Hoover, *Principles of mining*.
Lecture Notes.

4. Ore Dressing.

This course includes a detailed study of severing by means of breakers, rolls, stamps and fine grinding machines; the sizing and classification of pulps by mechanical, pneumatic, and hydraulic processes; the principles and importance of sizing and classifying; the separation and concentration by hydraulic and electrical methods and also by means of flotation processes.

Prerequisites: Course 3 of Department I; Courses 1 and 2 of Department II; Course 12 of Department VIII must precede or accompany.

Time: Class-room, three periods a week, first semester; two periods a week, second semester.

Text: Richards, *Ore Dressing and Concentration*.

5. Mine Administration and Accounts.

Particular stress is laid on the business aspects of mining operations. The value of keeping tabulated record of different grades of work and its cost from day to day is urged as a means of constantly reducing the fixed charges and of doing away with much of the extraordinary expenditures without reducing the efficiency of the work. The devising of methods of increasing the output with limited working forces is emphasized.

The subject of labor in its various phases, the details of supplies, mine accounts, statement of cost, and monthly reports are discussed.

Time: Class-room, one period a week, second semester.

6. Examination of Mines.

The main object sought in this course is to train the student sufficiently in expert mine examination work to enable him to report intelligently upon a mining proposition as to the advisability of purchase or of operation.

Practice is afforded in making regular reports, complete in every respect, on different kinds of mining properties. Each student is assigned a different mine or property to examine. In case the mine has been reported upon in previous years, detailed comparison of the results is afterwards made.

Among the more important topics usually considered are the topography of the district as an index to its accessibility, outside construction, the character of the geological formations, the geological structure (particularly as affecting the ore bodies), the character and disposition of the ores, the amount of ore developed, the probable extent of the unexplored part of the deposit, the best method of extracting the ore, of concentrating it, of preparing it for shipment or treating it immediately for the metal, the water facilities and the facilities for transportation to market. Full computations are required, including estimates of the cost of each process, of the necessary plant.

Time: Class-room, one period a week, second semester.

Field, three periods a week, second semester.

7. Design of Mine Plant.

The student is assigned problems relating to a given mine. He makes the requisite surveys, plans the top-works, selects the requisite machinery for a special duty, and designs in detail and makes working drawings of those features of Hoisting, Haulage, or Drainage Plant, or of the Ore Handling Plant as may be assigned to him. On these portions he draws up specifications, bills of materials, and estimates of cost.

If an operating mine be selected for this, the entire work is examined, improvements incorporated, and suggestions made as to possible savings.

Time: Laboratory, three periods a week, first semester; six periods a week, second semester.

VII. DEPARTMENT OF METALLURGICAL ENGINEERING

PROFESSOR FAHRENWALD.

The aim of the Metallurgical Department is to give its graduates a thorough working knowledge of assaying, chemistry, mill-work and smelting processes; and to equip them with the knowledge necessary to the successful management of metallurgical plants, or to take charge of metallurgical operations.

This special training is given by lectures, readings, discussions, laboratory work and inspection of metallurgical plants.

1. Fire Assaying.

The instruction in assaying is given by means of lectures and laboratory experimentation, the practice in the laboratory illustrating the lecture-courses. The laboratory is well equipped with several different types of assay-furnaces for crucible work, scorification, and cupellation, and with everything that goes to make up a well furnished assay-office.

This course comprises fusion methods for gold, silver and lead. The crucible-assay of oxidized ores for gold and silver in the muffle and in the pot-furnace; crucible assay of sulphide ores for gold and silver by the iron, roasting, and preliminary fusion methods; also the crucible assay of lead ores. The scorification-assay of mattes and speisses, with preliminary wet treatment; assay of litharge and lead. In the assay of base-bullion, silver-bullion and gold-bullion, the methods in use in the United States mints are followed. Sampling and the preparation of the sample for assay; making cupels, and the management of the assay office and the special duties of practical assayers are considered.

Numerous samples are provided, all of which have been previously accurately assayed at the College, at the smelter whence they came, or at the mint. The student works upon these until he attains a high degree of proficiency. No student is allowed to pass this subject until he has become an experienced assayer.

Prerequisites: Course 3 of Department III, and Course 1 of Department V.

Time: Class-room, one period a week, second semester.

Laboratory, eight periods a week, second semester.

Text: Fulton, *Fire Assaying*.

2. Principles of Metallurgy.

A study of the physical and chemical properties of ores and metals as determinants in extraction-methods; furnaces, their classification and structure; fuels and thermal measurements; characteristic metallurgical processes; materials and products of metallurgical processes; alloys; thermal treatment of metals preparatory to their use.

Particular stress is laid upon the study of the more recent metallurgical practices and improvements of older processes. The course is supplemented by visits to neighboring plants.

Prerequisites: Course 1 of Department II; Course 1 of Department III; and Course 1 of Department V must precede or accompany.

Time: Class-room, three periods a week, first semester.

Text: Fulton, *Principles of Metallurgy*.

3. Metallurgy of Zinc and Minor Metals.

This subject takes up the roasting of zinc ores; zinc distillation process; furnaces; purification of spelter; and commercial consideration of such metals. The metallurgy of Antimony, Nickel, Tin, Bismuth, Tungsten and Arsenic.

Time: Class-room, two periods a week, second semester.

Lectures and Notes.

4. Metallurgy of Copper and Lead.

Occurrence of copper; roasting copper ores in heaps, stalls and roasting furnaces; blast-furnace smelting; pyritic smelting; reverberatory smelting; bassemerizing copper mattes; electrolytic refining of copper; selection of process and management of plant; occurrence of lead ores; methods of roasting and roasting furnaces; Corinthian, Silisian and English methods of reverberatory smelting; blast furnace smelting; calculation of blast furnace charges; and desilverization of base bullion.

Prerequisites: Course 2 of this department.

Time: Class-room, two periods a week, first semester.

Texts: Peters, *Principles of Copper Smelting*.

Hoffman, *Metallurgy of Lead*.

5. Metallurgy of Gold and Silver.

Occurrence of gold and silver; placer mining; the patio process; crushing and amalgamating machinery; pan amalgamation; chlorination by the vat and barrel process; cyaniding by the MacArthur-Forest and Siemens-Halske processes; modern methods of cyanide treatment of slimes by pressure and vacuum filters; lixiviation of silver ores; pyritic smelting; refining and parting of gold bullion.

Prerequisite: Course 2 of this department.

Time: Class-room, three periods a week, first semester.

Texts: McFarren, *Cyanide Practice*.

Del Mar, *Stamp Milling*.

6. Metallurgy of Iron and Steel.

Modern methods for the production of pig iron, wrought iron and steel; the iron blast-furnace; white cast-iron; gray cast-iron and spiegel-iron; puddling; wrought-iron; the Bessemer and Siemens-Martin processes; steel.

Prerequisite: Course 2 of this department.

Time: Class-room, two periods a week, second semester.

Text: Stoughton, *Metallurgy of Iron and Steel*.

7. Metallurgical Calculations.

A course based on Richard's Metallurgical Calculation. It is designed to bring the student in contact with the more important calculations in connection with the practice of thermo-chemistry and various smelting operations, also electro-metallurgy.

Time: Class-room, one period a week, first semester.

8. Metallurgical Plant and Design.

The student devotes his time to detailed and original plans for a plant for ore treatment. From year to year the conditions vary so that no two students have the same work. The working plans for part of the buildings, concentrators, furnaces, etc., are drawn up complete in every respect, the full bills of materials are made out for the portions of the work assigned, and the cost of the several parts carefully estimated according to the trade conditions and labor factors existing at the time. The entire work and all computations are carried out according to the best engineering practice and with the same care that actual construction operations require.

Prerequisites: Course 6 of Department IV; Course 6 of Department V; Course 6 of Department IV; and Course 2 of this department.

Time: Laboratory, three periods a week, first semester, and six periods a week, second semester.

9. Metallurgical Laboratory.

Laboratory work and investigation will be conducted along some of the following lines: Amalgamation of ores of gold and silver, chlorination of gold and silver ores, cyanidation of gold and silver ores, leaching methods for copper ores, electrolytic refining for copper and lead, slags.

Prerequisites: Courses 4, 5, 6 and 7 of this department must precede or accompany this course.

Time: Class-room, one period a week, second semester.

Laboratory, eight periods a week, second semester.

10. Metallurgy of Gold and Silver.

An advanced course for metallurgical students.

Texts: Clennel, *The Cyanide Hand Book*.

References: Julian and Smart, *Cyaniding Gold and Silver Ores*.

McFarren, *Cyanide Practice*.

Time: One period a week, first semester.

11. Furnaces.

This course is given by way of an extension of the topic "furnaces" as treated in Principles of Metallurgy. It is concerned with the theories of high temperature generation, heat conservation, measurement and control; and with the design of furnaces for various industrial purposes and for stated capacities; and with the erection and control of smelting furnaces in particular.

Time: Class-room, three periods a week, second semester.

Text: Damour, *Industrial Furnaces*.

Mining and Metallurgical Trips.

During the first semester of the junior year a number of trips are taken to the mines, mills, and smelters which are within easy reach of the School. The officials at the various plants have been uniformly courteous in allowing the School the op-

portunity to make these visits, and have placed at the disposal of the students everything essential to a clear understanding of the mode of operation.

These excursions give the student a chance to see in operation and practice what heretofore he may have known only theoretically and give him a command of the subject that cannot be obtained in the class room.

Among the properties visited and at the disposal of the School are:

The old Torrance and Merritt mines, three miles from the campus, in the Socorro Mountains. These mines were once rich producers, but are now being re-exploited.

The Merritt Mine has an incline shaft equipped with gasoline hoist and self-dumping skip, and a considerable amount of drifting, raises, winzes, and stopes. Practically all the operations of mining may be seen at these two mines.

The coal mines at Carthage, New Mexico, are within easy reach of the School and present to the student practical problems and their solution, in mining, haulage, ventilation, and water supply. The use of electricity in mining is prominently brought to the student's notice.

The zinc district at Kelly, New Mexico, brings out the fact that success in mining is not all luck. There are three large mines and three mills available for inspection, and the student sees in the mines that geology is a live subject and essential to successful mining. In the mills, he gets his first insight into ore dressing and learns that there is more than one way of doing the same thing.

The Southwestern Portland Cement Company's plant at El Paso is visited and studied from the mechanical point of view. Here are seen in action various types of crushers, grinders, elevators, conveyors, feeders, etc. The company's quarry is a fine example of open cut mining and the student sees the uses of churn drills in drilling holes for blasting large charges.

At the smelter in El Paso, the student sees the working and handling of a large custom plant. Practically everything in the line of copper, lead, and silver smelting is before him for

inspection. The methods of sampling, the blast roasting of lead ores, the roasting of copper ores, the blast furnace treatment of lead-silver ores, the blast furnace treatment of copper ores, the reverberatory smelting of copper ores, basic converting, casting machines, power houses, and assay offices are all made the subject of close observation.

Once in two years, a trip, open only to students who have taken work in the Mining or Metallurgical departments, is taken through the Southwest. The probable itinerary of this trip is as follows: Santa Rita, Hurley, Morenci, Clifton, Globe, Miami, Tombstone, Bisbee, Cananea, and Douglas. Mining operations conducted at these places take rank with the great mining camps of the world.

VIII. DEPARTMENT OF MECHANICAL ENGINEERING

PROFESSOR HANSON.

The aim of the department is to give the student a thorough training in the fundamental principles underlying engineering practice, in shopwork, drafting and designing, arranged to illustrate the principles taught in the class-room.

The school is situated near the mining camps which are equipped with the larger and heavier types of power and mining machinery, furnishing the student with excellent examples of modern power plant installation.

The following is a brief description of the courses offered:

1. Elementary Drawing.

A course designed for preparatory students in the use and care of instruments, with simple exercises in geometrical construction.

Time: Six periods a week, one semester.

2. Wood Shop.

The student is taught the use and care of wood-working tools. Exercises in simple joints are then assigned and, whenever possible, work having practical application is given.

Time: Six periods a week, first semester.

3. Mechanical Drawing.

This course comprises the drawing of thirty plates in the geometrical representation of objects by isometric and orthographic projections. Objects in various positions are projected orthographically and the relations between the different views are brought out; sections at different positions and the intersections of solids are represented. The latter part of the year is devoted to special practice in lettering and freehand sketching.

Prerequisites: Entrance requirements.

Time: Six periods a week, two semesters.

Text: French, *Engineering Drawing*.

4. Machine Drawing.

Here the student makes working drawings from machine parts; first while having this part directly before him, and later from a freehand sketch of the part, without having the latter to look at while drawing. He thereby becomes familiar not only with methods of dimensions, laying out and reading working drawings but also those of making and using sketches. Throughout the entire course particular stress is laid on neat lettering, correct dimensioning and symmetrical arrangement of drawings.

Prerequisite: Course 3 of this department.

Time: Six periods a week, first semester.

Text: French, *Engineering Drawing*.

5. Machine Design.

A study of the design of machine elements and modern machines and of the nature, strength and action under stress of the materials used in machine construction. Recitations are carried on including the discussion of problems suitable for illustration of important points. In the drafting room each student completes the design of some especially assigned simple machine.

Prerequisites: Courses 3 and 4 of this department; Course 4 of Department I must precede or accompany.

Time: Class-room, two periods a week, second semester.

Laboratory: Six periods a week, second semester.

6. Descriptive Geometry.

The representation of all geometrical magnitudes are made possible by means of orthographic projections. The student is required to solve various problems involving points, lines, surfaces and solids and demonstrate same at blackboard. A thorough knowledge of descriptive geometry is indispensable to the engineer.

Prerequisites: Course 2 of Department 1, and Course 3 of this department.

Time: Class-room, three periods a week, second semester.

Text: Higbee, *Descriptive Geometry*.

7. Heating and Ventilating.

The theory and principles are studied of the different systems of heating buildings by steam, hot air, hot water or combina-

tions of these systems. Calculations are made of the amounts of radiating surface required for each system and the auxiliary apparatus used with each. This is followed by a study of the different systems of ventilating.

Prerequisite: Course 2 of Department II.

Time: Class-room, three periods a week, first semester.

Text: Carpenter, *Heating and Ventilating*.

8. Steam Boilers.

One semester is devoted to the study of steam boilers. The lectures include the history, theory and design of modern steam boilers. Each student works out a complete design of a boiler.

Prerequisite: Course 2, Department II.

Time: Class-room, three periods a week, first semester.

Text: Peabody and Miller, *Steam Boilers*.

9. Steam Engines.

A general descriptive course on engines, their types, details, construction and management is given. The student is taught the use of the indicator, to take cards from an engine and correct the different valve events.

Prerequisite: Course 2, Department II.

Time: Class-room, three periods a week, one semester.

Text: Rippers, *Steam Engines*.

10. Air Compression and Pumping.

Part I. Discussion of pumping, pump problems, and pump details. Types of pumps: Force pumps, crank and flywheel, direct acting, duplex, compound and triple expansion pumps.

Part II. A study of the action of air during compression and expansion; its flow through pipes; and, also, the various types of air compressing and actuating machinery.

Prerequisite: Course 11, Department IV.

Time: Class-room, three periods a week, second semester.

Text: Barr, *Pumping Machinery*.

Peele, *Compressed Air*.

Electives will be offered in steam-electric, hydro-electric plants and refrigeration.

IX. ACADEMIC DEPARTMENT

PRINCIPAL GUNTER.

The minimum requirements for admission are one year of high school work consisting at least of one unit in English, one in algebra, and one optional. A two-year course is given corresponding closely to the tenth and eleventh grades of standard high schools.

Especial stress is placed on work in English writing. It is being recognized that a most necessary part of a technical graduate's equipment is an ability to express himself in concise, consecutive, idiomatic language. Slovenly, inconsequential, ambiguous English in a report, a letter, an application, can readily lose a desirable position to an otherwise valuable technical man. Nowadays, men who can do must also be able to show in written language what they can do, what they are doing, or what they have done. There being in the College, at present, no space for courses of this nature, some vigorous training of the sort must be required in the preparatory years.

The courses offered in the Academy are:

SECOND YEAR—FIRST SEMESTER.

Elementary Algebra.

A rapid review of factoring, linear equations, and square root and radicals is given during the first month. Quadratics including graphic representation, irrational equations, variations and the binominal theorem for positive and negative exponents are given special study.

Time: Five periods per week.

Texts: Hawkes, Luby ad Touton.

English II.

Classics: Standard English and American classics are read and discussed in class, the memorizing of some of the most significant passages is required. An attempt is made to cultivate

a taste for good literature. Supplementary reading from approved authors required.

Rhetoric: This deals with language as a medium through which ideas and thoughts are expressed; Description, Narration, Exposition and Argument.

Composition: Ability to write English.

Time: Five periods per week.

Texts: Brooks and Hubbard.

Plane Geometry.

Triangles, quadrilaterals, loci, arcs, chords, measure of angles and simple problems in construction are studied. They are developed by the inductive-deductive method, the inductive predominating.

Time: Five periods per week.

Texts: Wentworth and Smith.

SECOND YEAR—SECOND SEMESTER.

English II.

In this subject the work of the first semester is continued. *The Merchant of Venice* and *Hamlet* are read and discussed in class. As in the first semester, appropriate supplementary matter is read by each pupil.

Time: Five periods per week.

Texts: Brooks and Hubbard, *Composition and Rhetoric*.

Plane Geometry.

Work of first semester is continued. Books III, IV and V are studied. Deductive proofs predominate. The work is vitalized by solutions of simple exercises and practical problems requiring the use of the algebra of the previous year.

Time: Five periods per week.

Texts: Wentworth and Smith.

THIRD YEAR—FIRST SEMESTER.

English III.

I. History of American Literature.

II. Ability to Write Formal Themes.

III. Knowledge of American Literature: Washington's Farewell Address; Webster's Bunker Hill Oration; One Essay from Emerson; Holme's Poems (selected); Hawthorne's Short Stories; Marble Faun, or House of Seven Gables; Longfellow's Poems (selected); Lowell's Poems (selected); Short Stories from Poe; One Novel from Cooper.

An intensive knowledge of four of the above and a general reading knowledge of the others is required.

Time: Five periods per week.

Texts: Selected.

Physiography.

This course furnishes preparation for the college work to follow. It is largely geological. Erosion, the work of ground water, rivers and valleys, the sea and its shores, and movements of the earth's crust are studied. Laboratory work in which maps, rock formations, etc., are examined and studied is given in connection with the special topics.

Time: Five periods per week.

Physics.

This course runs throughout the entire year the aim being to familiarize the student with the principles of physics, and to serve as an introduction to applied mathematics. Attention is given to the preparation of records, and to the manipulation of apparatus. During this semester the subjects of mechanics, heat and work are studied.

Time: Four periods a week in class, with three hours laboratory.

Text: Millikan and Gale's *First Course in Physics*, with laboratory manual.

THIRD YEAR—SECOND SEMESTER.

English III.

I. History of English Literature.

II. Ability to Write Formal Themes.

III. Knowledge of English Literature: Burk's Speech of Conciliation; Macauley's Life of Johnson; Shakespeare's Macbeth, Hamlet, or King Lear.

Time: Five periods per week.

Text: Long, *English Literature*.

Physics.

This is a continuation of the first semester's work. Sound, light and electricity are treated in much the same manner as the subjects of the first half of the year. Throughout the course individual laboratory work is required. Each student must present a satisfactory note book of at least forty experiments performed by him during the year before credit will be allowed by instructor.

Time: Class-room, three periods per week.

Laboratory, six periods per week.

Text: Millikan and Gale, *Laboratory Manual*.

Solid Geometry.

The work for the second semester includes the usual theorems and constructions of good text books covering the relations of lines and planes in space; the properties and measurements of prisms, pyramids, cylinders, and cones; the sphere; and the spherical triangle.

Time: Five periods a week.

Text: Wentworth and Smith, *Solid Geometry*.

Drawing.

Instruction in elementary drawing is given during the entire course in the academy. This course is given to meet the requirement of the College for entrance into freshmen drawing, the student completing this course will be amply prepared for the more advanced work of the College.

Industrial Training.

Elementary shop practice is given academic students who are not otherwise overburdened with work. The scope and arrangement of shop work will be made by the instructor in charge. Students who do not intend to take a full college course will do well to take advantage of work in the shop.

FOREIGN LANGUAGES.

No foreign language is taught except Spanish, a speaking knowledge of which has recently become a great advantage, if not a necessity, to a large percentage of the young men who engage in any of the line of work for which they may fit themselves at the School of Mines. For that reason special attention is given to the study of the language at this institution. The course offered continues through two years and is designed to give the student a practical speaking knowledge of Spanish. The location of the New Mexico School of Mines affords an unsurpassed opportunity for acquiring this knowledge, for in Socorro and vicinity Spanish is as generally spoken as English.

1. Spanish.

The work is based on Worman's First and Second Spanish Readers. A part of the class exercise each day consists in cross-translations, both oral and written. Special stress is placed upon conversational exercises. Attention is given to the elementary principles of the grammar of the language with the idea of learning the grammar from the language rather than the language from the grammar.

Time: Five periods a week, one year.

Texts: Worman, *First and Second Spanish Readers*.

Garner, *Spanish Grammar*.

2. Spanish.

Alarcon's *El Capitan Veneno*, and Valera's *El Pajaro Verde* are read. The study of Spanish grammar is pursued systematically, De Tornos' *Spanish Grammar* being used as a text. Five periods each week are devoted to conversation in Spanish and to cross-translation no particular text-book being used in this work.

Prerequisite: Course 1 of this department.

Time: Five periods a week, one year.

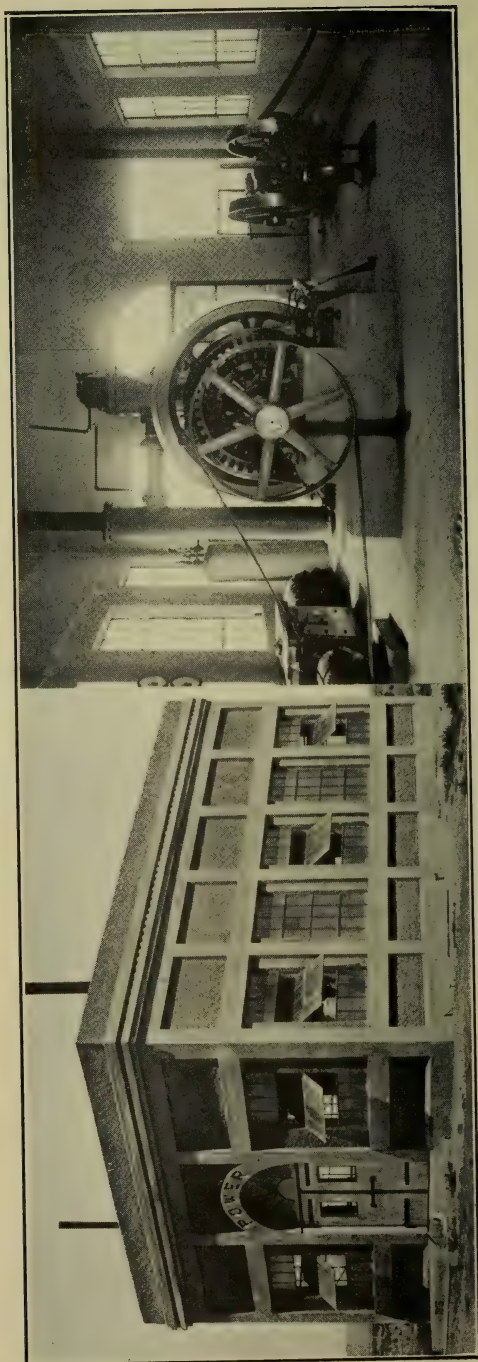
Instruction in Spanish is given by a Spanish-American who holds a scholarship in the institution. Such instructor is named at the beginning of the school year by the president. Two units are required in either Latin, Greek, French, German or Spanish for graduation from the college.

ACADEMIC CLASS SCHEDULE—FIRST SEMESTER.

PERIOD	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
A. M. 8:00 8:50 9:40 10:30 11:20	Algebra II English III Physiography P. Geometry English II	Algebra II English III Physiography P. Geometry English II	Algebra II English III Physiography P. Geometry English II	Algebra II English III Physiography P. Geometry English II	Algebra II English III Physiography P. Geometry English II	
P. M. 1:00 2:00	Spanish Physics	Spanish Physics	Spanish Physics	Spanish Phys. Lab. (2 to 5)	Spanish Physics	Drawing and Shop

ACADEMIC CLASS SCHEDULE—SECOND SEMESTER.

PERIOD	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
A. M. 8:00 8:50 9:40 10:30 11:20	S. Geometry English III Algebra II P. Geometry English II	S. Geometry English III P. Geometry Algebra II English II	S. Geometry English III Algebra II P. Geometry English II	S. Geometry English III P. Geometry Algebra II English II	S. Geometry English III Algebra II P. Geometry English II	
P. M. 1:00 2:00	Spanish Physics	Spanish Physics	Spanish Physics	Spanish Phys. Lab. (2 to 5)	Spanish Physics	Drawing and Shop



NEW POWER HOUSE, WITH INTERIOR VIEW

BUILDINGS AND GROUNDS

BUILDINGS AND GROUNDS

The Campus.

The State School of Mines campus contains 32 acres of nearly level ground on the outskirts of the city of Socorro. Groves of trees have been planted and trees line the walks and drives.

Main Building.

The main building consists of three stories and a good basement. It is T-shaped, 135 feet long by 100 feet deep, the central rear wing being 54x32 feet. It is constructed in a very substantial manner of a beautiful gray granite in broken ashler and is trimmed with Arizona red sandstone.

The building is handsomely finished throughout in oiled hard woods. It is well ventilated, heated with a good hot-water system, piped for water and gas, and wired for electricity for illumination and for experimental purposes.

As now arranged the main floor of this building contains the president's office, the mineralogical museum, the qualitative chemical laboratory and instructor's office, the assay laboratory and balance rooms, and a lecture room. The basement contains two lecture rooms, the physical laboratory, and instructor's private mineralogical laboratory, the quantitative chemical laboratory, the electro-chemical laboratory, an instructor's private chemical laboratory, the chemical supply rooms, a photographic dark room, the hot water heating plant, and the lavatory. A lecture room, now occupied by the department of mathematics, is located on the second floor. The main library occupies the third floor.

Engineering Building.

The new engineering building is built in the shape of a Greek cross, 60 feet wide by 120 feet long, and 24 feet in height. It is of steel and concrete, with concrete roof, steel sash and heavy 3-ply tin doors; making the building entirely fire proof. There are 11 steel monitor type trusses in this building six of 30-foot spans each, and five of 40-foot spans each. The trusses being carried on steel columns and the panels between the columns

filled in with steel studdings and girders to which are fastened heavy metal hy-rib. The building is plastered inside and out with cement. The monitor is about 10 feet wide and has a 3-foot top hung steel sash along both sides along the wings. The overhead sash serve also as ventilators being operated below by an endless chain passing over a pulley which in turn operates a worm gear. Heavy re-inforced window lights are used throughout the building. This system of lighting diffuses the light so that all parts of the building are equally well lighted. This building, with the exception of the south wing, has been completed during the past year.

Power Plant.

The new power plant building just completed is constructed of re-inforced concrete. The building is 34 feet long, 24 feet wide and 18 feet high. It is well lighted by 14 windows, each 4x6 feet, having heavy re-inforced glass. The structure is absolutely fire proof. The building is one of the most attractive structures on the grounds.

Ore Dressing and Treating Plant.

The building housing the machinery of this plant is a temporary building and is 50x40 feet in size, two stories high. This building is sufficiently large and well lighted for carrying on the work of the School at the present time. It is intended within a few years to erect a permanent and larger building for carrying on the metallurgical operations.

Dormitory.

The State School of Mines suffered long for lack of dormitory accommodations. In fact, it is known that many students who would otherwise have come to the State School of Mines in years past went to other institutions because of the lack of the lower cost of living which a dormitory here would have afforded. However, the \$15,000 generously appropriated by the territorial legislature was expended with the result that the School of Mines is equipped with what is probably the best dormitory in New Mexico. The building is heated with hot water and lighted with electricity. There are a dining room and kitchen in connection, also a bath room on each of the two floors and a shower bath in the basement. The assembly room, on the first floor,

which is now equipped for the accommodation of the academic department, promises to meet all the requirements of that department for some time to come. The building is designed to afford accommodations for about thirty students.

Students are accommodated with board and lodging at the dormitory at the rate of \$22.50 a month, they being required to furnish only their own bed covering. This rate is fixed for cases in which two students occupy the same room. Five dollars a month additional is charged a student who wishes a room by himself, and no student will be accommodated in this way to the exclusion of another student from dormitory privileges. These fees are required to be paid monthly in advance. A deposit of five dollars is required, also, of each student in the dormitory to cover the cost of possible breakage or damage to his room or its furniture. After paying the cost of such damage or breakage, if any, the balance of this fee is returned to the student at the end of the year.

Rooms in the dormitory are assigned to students in the order of application. Dormitory privileges will be withdrawn from any student for boisterous and disorderly conduct in violation of the rules and regulations governing their action while in or about the building. The privilege of the dormitory, is therefore, for students of good behavior and those who wish to study, without being interrupted.

Conduct of Students.

In the government of the School of Mines the largest liberty consistent with good work is allowed. Students are expected to conduct themselves as gentlemen upon all occasions and to show such respect for law, order, morality, personal honor, and the rights of others as is demanded of good citizenship. It is also hereby expressly stipulated that the use of intoxicating liquors, whether inside or outside the campus, and the frequenting of saloons and other places of questionable character are strictly prohibited. It is assumed that the act of registering as a student implies full acceptance of this policy. Failure on the part of any student to comply with this policy will be considered sufficient cause for removal from the institution.

EQUIPMENT.

Chemical Laboratories.

The chemical laboratories have recently been greatly enlarged and improved. As now arranged they occupy the entire south wing of the main building, while the store room, private laboratory, and chemical lecture room are located in the central section of the same building. Elements of chemistry and qualitative analysis are taught in the large laboratory on the main floor. The room, which is exceptionally well lighted and ventilated, is equipped with large hoods, a balance room, and twenty-four desks, each of which is supplied with gas, water, and electric light.

The basement laboratory has recently been remodeled and fitted with large windows, glass partitions, and modern desks. The east half of it is used for quantitative analysis and wet assaying. There are large hoods in each end which are supplied with hot plates and drying ovens, while each desk is equipped with an Alberine stone sink, water, gas, and electric light.

In the west half of the basement there are the instructor's laboratory, electro-chemical laboratory, and balance room. The latter is fully equipped with the best analytical balances supported upon a solid concrete table which is entirely free from vibration. The electro-chemical laboratory is supplied with current from a modern storage battery plant, consisting of a motor-generator, storage cells, and a switch-board so arranged that each student may obtain any current he desires for analytical or other electro chemical experiments. There is also a supply of alternating current from the city circuit which may be used for light and for the small electric furnaces, in case of an accident to the School of Mines plant.

The laboratory is very completely equipped not only with all apparatus, chemicals, and supplies needed for the various courses, but the stock includes a large amount of pure chemicals and special apparatus, including standardized burettes, flasks, and weights which are used for the most accurate rock analysis and research work.

All apparatus is loaned to the students. Chemicals and supplies are furnished at cost.

Assay Laboratory.

The assay laboratory occupies the main floor and basement of the west wing of the main building. The furnaces are all new and include muffle gasoline blow-pipe furnaces of different types and large muffle coal and coke furnaces. This department is conveniently arranged with shelving, drawers and boxing for fluxes, and other assaying materials and supplies.

A weighing-room containing a number of Becker's balances is conveniently located between the furnace-room and the lecture-room. In the grinding room, which is in the basement, there are various types of laboratory machines for carrying on experimental work.

Physical Laboratory.

The physical laboratory occupies the east side of the north basement of the main building and contains the usual apparatus for illustrating the facts and laws of physics. In addition there has just been added at a considerable expense all the apparatus necessary to perform the quantitative experiments outlined in Course 2 of Department II.

Petrographical Laboratory.

For the microscopic study of rocks both in elementary and advanced or graduate work the School is well supplied with rocks in thin sections representing the various types of igneous, metamorphic, and sedimentary rocks accompanied by hand specimens, giving the student an opportunity to study the microscopic and megascopic characters of the rocks at the same time. The laboratory is well equipped with standard up-to-date microscopes with all accessories; also, a camera for microphotographic work with accessories for oblique and vertical illumination; also a Sauveur and Boylston polishing machine with electric power attachment where the students in petrography are taught how to make and mount thin sections and prepare polished surfaces of the opaque minerals.

Mineralogical Laboratory.

For the study of minerals by physical characters and blow pipe test, the School is especially well provided with an abundance of material of various ores and minerals for blow pipe determinations. Large collections for this purpose have recently been added to the School and the minerals are so arranged that no two students work with the same minerals the same day, thereby stimulating thorough systematic search for the elements and correct determination of the mineral specimens. The laboratory is well equipped with all necessary apparatus to carry on this work in an efficient and up-to-date manner.

Mineralogical Museum.

The Mineralogical Museum, with instructor's office, occupies the center north wing of the first floor of the main building. The School owns a very fine collection of minerals and rocks of all kinds. These are arranged systematically, forming units for the various courses in geology rather than for showy display. The minerals and rocks from the various mining districts are segregated, thereby giving the student the best possible opportunity of studying the ores and rocks of a district without having actually visited the field. The Museum is well supplied with such district collections throughout the United States, Mexico, and Canada. New specimens are being added most every day in the year.

Electrical Equipment.

The equipment of the new power plant consists of two semi-Diesel Fairbanks-Morse Company engines. The smaller of the two engines delivers about 15-horse power at full load, and is belted to an air compressor and also to a direct current dynamo. The compressor is used to store air in two cylindrical reservoirs at a pressure of 120 pounds per square inch for starting larger engine. The fuel oil used by these engines may be any crude heavy oil or distillate. The larger engine is controlled by an inertia governor on the main shaft and varies the supply of oil according to the speed. The cylinder is lubricated by forced feed. The larger of these two engines is intended to furnish most of the power on the campus. It is vertical and runs with very little vibration. The top of the cylinder is about eight feet above the

base of the engine. The fly wheel is about seven feet in diameter and weighs nearly five tons. It is mounted between the vertical engine and the alternating current engine which furnishes power to the engineering and metallurgical buildings. The alternating current generator gives a 3-phase current, so that either 3-phase current or single phase motors may be used in the various buildings. The larger engine and alternator will deliver 37.5 kilowatts at 125 volts when run at 1250 revolutions per minute. The current is about 47 amperes per phase at ordinary full load. The field coils of the alternator are excited by means of a generator, which is run from the main shaft of the larger engine. The generator can deliver 40 amperes and 125 volts when run at 1250 revolutions per minute. The direct current dynamo connected with the smaller engine will deliver 60 amperes at 125 volts when run at 1250 revolutions per minute. The frequency of the alternating current at the ordinary speed of the larger engine is 60 cycles per second.

There are two switch boards, one for the alternating current power circuits and one for the direct current power circuits. The former was designed and constructed by the Westinghouse Electric Company, and the latter by the General Electric Company. The former contains three panels; an exciter panel, a generator panel, and a feeder panel. There are thirteen ammeters and volt-meters mounted on these panels, together with a three-phase watt meter. All switches are used in the main alternating current circuit and in the various feeding lines, which run to the 3-phase and single phase meters. It is possible to see at a glance the amount of current that is being used on these branches and the total amount of power that is being used on all the motors.

The voltage of each phase can also be measured. Current transformers are used in connection with the 3-phase watt meter. There are the usual arrangements for ground detection. The switch board also provides for the connection of another similar power unit to run in synchronism with the present unit. This power plant is among the neatest and most complete in the West.

Mechanical Equipment.

The following equipment for the new engineering building has just been installed, to-wit:

One wood-turning lathe, 12x36 inches, with outside face plates, floor stand and rest.

Two similar but smaller lathes, 12x24 inches.

One planer, 24x6 inches.

One joiner, 9 inches.

One band-saw, 30 inches.

One hand-trimmer, 15x5 inches.

One saw-table.

One improved oilstone grinder.

All of these machines are direct-connected with A. C. motors.

For the new draughting room there has been installed:

Twenty drawing tables, 33x60 inches, with drawers for instruments and materials.

Twenty stools with adjustable screw bottoms.

One five-section filing cabinet, large size.

Metallurgical Equipment.

It is expected to install during the summer, crushers, stamp mill, jigs, rolls, concentrator, ball mill, and various other machines for carrying on experimental ore testing.

ENGINEERING INSTRUMENTS.

The Civil Engineering Department has all the instruments necessary for land, railroad, irrigation, mine, and topographic surveying. These include chains, tapes, range-poles, leveling rods, wye and dumpey levels, complete transits, and plane tables. In purchasing instruments for this department only the best grade has been considered and the student has the opportunity to become familiar with the product of such well known manufacturers as W. & L. E. Gurley, Eugene Dietzgen, Buff & Buff, etc.

The engineering department has recently purchased a new modern Gurley light mountain transit of the type, 27 A. The

instrument has an auxiliary detachable telescope for use in mine shaft surveying.

Draughting Rooms.

A spacious, well-lighted draughting-room is provided in the mechanical building. Opening off from it are the instructor's office, supply-room, blue-print room with large printing frame on steel track, developing-vat, and drying rack.

A drawing table is furnished each student. There are private spaces for his materials and instruments. An Ingersoll-Rand drill and other pieces of machinery are used as models.

LIBRARIES.

The libraries of the New Mexico School of Mines consist of a general library and department libraries.

In the main library are the works of reference, the encyclopedias, dictionaries, journals, magazines, proceedings of the learned societies, periodical issues of other colleges, reports of federal, state and foreign surveys, official maps, plats, and atlases, and volumes on history, travel, and philosophy.

The following periodicals are received by the School:

Engineering and Mining Journal.

Mining and Scientific Press.

Engineering Record.

Power

Engineering News.

Mining Science.

The Mining World.

Chemical and Metallurgical Journal.

Journal of the American Chemical Society.

Journal of Industrial and Engineering Chemistry.

Chemical Abstracts.

Geographic Magazine.

Economic Geology.

School of Mines Quarterly.

New Mexico Journal of Education.

All the U. S. Geological Survey Publications.

U. S. Bureau of Mines Publication.

Canadian Geological Survey Publications.

Various daily and weekly papers.

Libraries are located in the several departments of the School. These are essentially working libraries. They consist of carefully chosen treaties, text-books, monographs, special contributions and author's separates, pertaining to the respective divisions.

Powell Library.—The School has come into possession of the private library of the late Major John W. Powell of Washington, D. C., who for many years was director of the United States Geological Survey. The collection embraces several thousand titles. The volumes are chiefly works on mining, geology, philosophy and many rare monographs of great practical value. Especially well represented is the literature relating to the Rocky Mountain region and the great Southwest. It was in these fields that Major Powell did most of his work which has had such an important influence on the development of the mining industry. It therefore seems particularly fitting that the library of this famous man, who has been so long identified with this western country, should find a permanent home in New Mexico.

SOCORRO MOUNTAIN MINES.

The silver mines at the base of Socorro Mountain, only about two miles west of the School campus, afford excellent opportunity for the practice of mine-surveying and for a study of some features of practical mining. The ore-bodies with associated geological structures and many other features will interest the student of mining and geological engineering.

EXPENSES.

Matriculation Fee.

Matriculation fee of five dollars is required of each new

student before beginning work in the School for the first time and, of course, is paid only once.

Tuition Fee.

The fee for tuition is fifteen dollars a semester except to citizens of New Mexico, the tuition fee for the latter being five dollars a semester. This is payable at registration, and its payment after matriculation admits the student to all class-room instruction. Students who hold scholarships pay no fee for tuition.

Laboratory Fees.

The laboratory fees are intended to cover the cost of gas, water and materials for which the student does not pay directly and to compensate for the depreciation, due to use, in the value of the apparatus. These fees are payable at the time of registration and are as follows: General Chemistry, Quantitative Analysis, Water and Fuel Analysis, Inorganic Preparations, Organic Chemistry, Electro-Analysis, Qualitative Analysis, Ore Analysis, each \$7.50; Fire Assaying, \$10.00; Mineralogy (Blow-pipe Analysis), \$6.00; Metallurgical Laboratory, \$3.00; Shop, \$5.00; Mine Examination, \$1.00; Elementary Physics, \$3.00; Heat and Light, \$4.00; Experimental Mechanics, \$4.00; Electricity and Magnetism, \$4.00; Alternating Current, \$10.00.

A deposit of \$2.00 is required from each student who registers for any of the foregoing courses. This deposit will be returned to the student after deducting any amount which may be due from the breakage or damage to apparatus.

Graduation Fee.

The graduation fee, payable on delivery of diploma, is as follows:

Mining, Metallurgical, Geological, or Civil Engineer.....	\$25.00
Bachelor of Science.....	5.00

Board and Rooms.

Rooms may be obtained at a cost varying from \$6.00 to \$8.00 a month; board at the hotels and best boarding houses for \$7.00 a week. The cost of living at the dormitory is \$22.50 a month.

Books and Other Supplies.

Books and other supplies for students are furnished through the office at publishers' prices with the freight or express charges

added. A considerable saving is thus made in behalf of the student.

Summary of Annual Expenses.

A close approximation of a student's necessary annual expenses is tabulated below. By the practice of extreme economy a student may, of course, cut his expenses somewhat below the figures here given:

Board and room at dormitory.....	\$202.50
Books and other supplies.....	60.00
Laboratory and other fees.....	25.00
Total.....	\$287.50

SCHOLARSHIPS.

There are a few scholarships available each year in this institution which carry with them certain emoluments in cash and free tuition.

Instructor's Scholarship.—Through the wisdom of the Board of Regents of the School of Mines there have been provided from two to five scholarships, discretionary to the president, carrying free tuition and from \$150 to \$200 per year. These scholarships are awarded only to worthy young men who have satisfactorily completed at least the college freshman work and who are otherwise worthy of recognition. The students carrying such scholarships shall be selected by the president, and they shall be required to give from one hour to not more than two hours each day instructions in the class room or in the field, shop, or in operating and having charge of machinery, etc., during the active school year, as they may be qualified in or are capable of doing.

School of Mines County Scholarships.—Scholarships are open to one student from each county in New Mexico. These scholarships yield free tuition and are awarded by the president to indigent and worthy students.

Allis-Chalmers Scholarship.—To one member of each year's graduating class there is offered by the Allis-Chalmers Company,

manufacturers of mining and heavy machinery, with large works at Chicago, Milwaukee and Scranton, an opportunity for four months' study and employment in any of its plants and an emolument of \$150.00. This scholarship is awarded by the Board of Regents on the recommendation of the Faculty from those graduates of the year filing application before the 10th of June. The opportunity is an exceptional one to observe and study the building of all kinds of modern mining and metallurgical constructions.

SUMMER WORK.

The proximity of the School to mineral properties, mines, and smelters makes it easy for the students to secure employment during the summer and at the same time to acquire much practical experience in the line of his profession. That this advantage has been appreciated is shown by the large proportion of students who yearly make use of this opportunity. During the past years, land-surveying, mine-surveying, geological surveying, assaying and mining, have been attractive fields of work for students during vacation.

DEGREES.

The degrees of Bachelor of Science, Mining Engineer, Metallurgical Engineer, Geological Engineer, and Civil Engineer, are conferred by the Board of Regents upon recommendation of the Faculty.

The candidate for a degree must announce his candidacy at the beginning of the school year at whose termination he expects to receive the degree. This announcement must be in writing and must specify both the curriculum and the degree sought.

The degree of Bachelor of Science is conferred upon those who, as students of the institution, have completed the prescribed collegiate courses of any one of the several curricula. This degree is also conferred upon those who, as students of this

institution, have completed the courses which represent one full year's work in any one of the several curricula and have given satisfactory evidence of having previously completed the other courses of that curriculum.

The degree of Mining Engineer is conferred upon each one who, as a student of this institution, has completed the prescribed course of the four-year curriculum in Mining Engineering, has presented an original and satisfactory thesis in the line of his work, and has done two years of professional work, of which one year has been in a position of responsibility. The degree is also conferred upon each one who, as a student of this institution, has completed the courses which represent one full year's work in one of the four-year curricula just named, has given satisfactory evidence of having previously completed the other courses of that curriculum and has complied with the specified conditions concerning a thesis and professional work.

The degree of Metallurgical Engineer, Geological Engineer, and Civil Engineer, is offered upon terms similar to those required in the case of the Mining Engineer.

Work done at other colleges by candidates for a degree may be accepted so far as it corresponds to the work done here, but in each case the Faculty reserves the right to decide whether the previous work has been satisfactory.

It is expected that the thesis in each case shall be prepared with sufficient care and exhibit sufficient intrinsic evidence of independent investigation to warrant its publication in whole or in part.

CHEMICAL ANALYSIS, ASSAYING, AND ORE TESTING.

The wide demand which exists in the great mining districts of the Southwest for disinterested and scientific tests and practical investigations has led to the establishment by the New Mexico State School of Mines of a bureau for conducting commercial work relating to mining and metallurgy.

The performance of such work is made possible and accurate results assured by reason of the exceptional facilities of the lab-

oratories of the School and the extensive practical experience of the instructors. The rapidly increasing amount of this work intrusted to the School is sufficient evidence in itself that the plan has been long needed to further the development of the mineral resources of the region.

A special act of the Legislature makes provision for carrying on commercial testing. The section from the law governing the School of Mines, Chapter 138, Section 38, Acts of 1889, reads: "The Board of Trustees shall require such compensation for all assays, analyses, mill-tests or other services performed by said institution as it may deem reasonable, and the same shall be collected and paid into the treasury of the School of Mines." By special resolution it is required that all charges shall be paid in advance. Prices for work will be sent on application.

FREE DETERMINATIONS.

For the benefit of prospectors and others, elementary blow-pipe and physical tests will be made of any rocks, ores or other mineralogical material when sent to the School for their proper identification and classification. Such work is done to encourage prospecting and to more fully exploit the mineral resources of New Mexico so little comprehended at the present time. For such work as indicated in this paragraph no charges will be made.

NEW SPECIAL APPROPRIATION.

During the legislative session of 1915, the legislature provided a special appropriation of \$20,000 to be expended in new buildings, electrical, power, and metallurgical equipment for practical and demonstrative work in the methods of ore dressing, milling, etc.

Three new buildings have been erected from this special ap-

propriation; descriptions of which will be found elsewhere in the register.

Some of the new machinery and equipment have been ordered and more will be ordered soon. The whole of the installation will be made during the summer and ready for the opening of the fall term of school.

DIRECTORY OF GRADUATES
AND STUDENTS

DIRECTORY OF GRADUATES AND STUDENTS†

ARTHUR H. ABERNATHY

Kelly, New Mexico

Student, 1898-1901. From Pinos, Zacatecas, Mexico. Assayer, Cananea Smelting Works, Cananea, Sonora, Mexico, 1901; Assistant sampler, Cia. Minera de Penoles, Mapimi, Durango, Mexico, 1909-1910; Sampling foreman same company, 1910-1914; Special student at New Mexico School of Mines, 1914-1915; Sampling foreman Cia. Minera de Penoles, Mapimi, Durango, Mexico, 1915-1916; Mine foreman, Ozark Mining and Smelting Co., Kelly, New Mexico, 1916—.

ANTONIO ABEYTA

Pachuca, Mexico

(B. S. in Metallurgical Engineering, New Mexico School of Mines, 1914)

Foreman at San Gertrudes Mine, Pachuca, Mexico, 1914—.

RAY COOK AHNEFELDT

Riverside, California

Entered freshman class of Civil Engineering, 1913—.

EUGENE CARTER ANDERSON

Centreville, Mississippi

(B. S. Miss. A. & M. College, 1913.)

Graduate student. Entered sophomore and junior classes of Mining and Civil Engineering, 1915—.

ALEXANDER ANDREAS, JR.

Laconia, New Hampshire

Entered Freshman class 1915—.

GEORGE C. BAER

Mogollon, New Mexico

(B. S. in Mining Engineering, New Mexico School of Mines, 1910.)

Student, 1907-1910. From Hillsdale, Michigan. Assayer, Tri-Bullion Company, Kelly, New Mexico, 1910; Millman, Socorro Mines Company, Mogollon, New Mexico, 1911; Mill foreman, same company, 1912; Engineer, same company, 1912—.

PETER A. BALLARD

Rapid City, South Dakota

(B. S. in Mining Engineering, New Mexico School of Mines, 1916.)

Prospecting for oil in Wyoming, 1916-17.

JAMES HENRY BATCHELDER, JR.

Socorro, New Mexico

(B. S., New Mexico School of Mines, 1909; E. M., 1910.)

Student, 1906-1910. From Exeter, New Hampshire. Mining, Chloride, New Mexico, 1911; Farming, San Acacio, New Mexico, 1911—.

†Information concerning former students not here listed or concerning changes of address of those already listed will be gladly received.

THOMAS HORTON BENTLEY Calgary, Alberta, Canada
(B. S., New Mexico School of Mines, 1909; E. M. 1910.)

Student, 1907-1910. From Burro Mountains, New Mexico. Surveyor with Mildon & Russell, Nacozari, Sonora, Mexico, 1910; General engineering work, Hermosillo, Sonora, Mexico, 1911; Mining engineer, Portland, Oregon, 1911; Assistant superintendent, Norton Griffiths Steel Construction Company of London, England, with headquarters at Vancouver, British Columbia, Canada, 1912; Superintendent, same company, with headquarters at Calgary, Alberta, Canada, 1912—.

JAMES FIELDING BERRY Angangueo, Michiocoan, Mexico

Student, 1904-1905. From Socorro, New Mexico. Assayer, American Smelting & Refining Company, Aguascalientes, Mexico, 1905; Assayer, City of Mexico, Mexico, 1906-1907; Chemist, Cia Metalurgica y Refinadora del Pacifico, Fundicion, Sonora, Mexico, 1908; Assistant mine superintendent, American Smelting & Refining Company, Angangueo, Michiocoan, Mexico, 1909-1914; Mine superintendent, San Gertrudes Company, Pachuca, Mexico, 1914—.

LOUIS AUGUST BERTRAND Upland, Nebraska

Student, 1895-1896. From Conway, Iowa. Student, Ecole Professionalla de l'East, Nancy, Lorraine, 1890-1894. Instructor in Mathematics and French, New Mexico School of Mines, 1895-1896; Chemist, El Paso Smelting Works, El Paso, Texas; Assayer and surveyor, Consolidated Kansas City Smelting & Refining Company, Chihuahua, Mexico; Superintendent, Carmen Mines, Coahuila, Mexico; Mine superintendent, Cia. Minera de Penoles, Mapimi, Durango, Mexico, 1901-1903; Farming in Nebraska, 1903—.

ALEXANDER LOUIS BLACKBURN Austin, Texas

Entered Sophomore class of Mining Engineering, 1915—.

H. LAWRENCE BROWN Los Angeles, California

Student, 1903-1905. From Chicago, Illinois. Positions: Assayer, Ernestine Mining Company, Mogollon, New Mexico; Engineer, Cia. Concheno Beneficiador, Mexico; Mill superintendent, Milwaukee Gold Extraction Company, Phillipsburg, Montana; Engineer, Transvaal Copper Company, Sonora, Mexico; Manager, Morning Star Mining Company, Ophir, Colorado; Manager, San Carlos Mining Company, Sonora, Mexico; Manager of six properties and consulting engineer, Cobalt, Ontario, Canada; Superintendent, Haile Gold Mine, Kershaw, South Carolina; Exploration work in Venezuela, South America; Mill superintendent, National Mining Company, National, Nevada; at present, mining engineer with the American Metal Company with headquarters at Los Angeles, California.

PHILLIP A. CAMPREDON

Metcalf, Arizona

(B. S. in Metallurgical Engineering, New Mexico School of Mines,
1914.)

Assayer for Shannon Copper Company, Metcalf, Arizona, 1915—.

PETER EDWARD CANNON

Roswell, New Mexico

Entered Freshman class 1916—.

R. HARLAND CASE

Deming, New Mexico

Student, 1902-1905, from Cerrillos, New Mexico. Chemist, Compañia Metalurgica de Torreon, Coahuila, Mexico, 1905-1906; Assistant superintendent, Bonanza Mines, Zacatecas, Mexico, 1906; Assistant manager, Stephenson-Bennett Mining and Milling Company, Organ, New Mexico, 1906-1907; Consulting engineer, Western Mining, Milling & Leasing Company, Colorado Springs, Colorado, 1907-1908; Mining engineer, Deming, New Mexico.

WHATLEY L. CHANDLER, JR.

St. Louis, Missouri

Entered Freshman class 1916—.

VIVIAN V. CLARK

Seattle, Washington

Student, 1896-1898, from Kelly, New Mexico. Assayer, Bland Mining Company, Bland, New Mexico, 1898-1899; Superintendent, Navajo Gold Mining Company, Bland, New Mexico, 1900; Manager, Higuera Gold Mining Company, Sinaloa, Mexico, 1901; Mine operator, Albuquerque, New Mexico, 1902; Manager Bunker Hill Mining and Smelting Company, Reiter, Washington, 1903-1908; Consulting engineer, Consolidated Exploration Mines Company of New York, and allied syndicates, 1909-1910; President, Northern Engineering Company, Seattle, Washington, 1910-1912; President, Clark Mining Machinery Company, successors to Northern Engineering Company, Seattle, Washington, 1912—.

DAVID JOSHUE CLOYD

Golconda, Arizona

Student, 1899-1900. From Decatur, Illinois. Chemist and assayer, Wardman's Assay Office, Aguascalientes, Mexico, 1900-1906; Assistant superintendent, Cia. Minera del Tiro General, and assistant superintendent, Cia. del Ferrocarril Central de Potosi, Charcas, San Luis Potosi, Mexico, 1906-1908; Assayer and Chemist, Dailey, Wisner & Company, Torreon, Coahuila, Mexico, 1908; Chief assayer and chemist, Mazapil Copper Company, Saltillo plant, Saltillo, Coahuila, Mexico, 1911-13; Shift boss in the Concentrating Mill, Union Basin Mining Company, Golconda, Arizona, 1915—.

SAMUEL COCKERILL

Indianapolis, Indiana

(B. S., New Mexico School of Mines, 1906.)

Student, 1904-1906. From North Fork, Virginia. Post-graduate engineering course, Allis-Chalmers Company, 1907-1908; Milwaukee Coke and Gas Company, Milwaukee, Wisconsin, 1908-1910; Citizens Gas Company, Indianapolis, Indiana, 1910—.

- HENRY A. COOK** Arlington, New Jersey
Entered Sophomore class 1916—.
- HARRY H. DEVEREUX** Springfield, Illinois
Entered Academic Department 1915—.
- LEON DOMINION** New York, New York
(B. A. Roberts College, Constantinople, 1896; C. I. M., Mining School University of Liege, 1900.)
Graduate student, 1903-1904. From Constantinople, Turkey. Assistant, United States Geological Survey, 1903; Instructor in Mathematics, New Mexico School of Mines, 1903-1904; Engineer, Victor Fuel & Iron Company, Denver, Colorado, 1904-1906; Superintendent, Bonanza Mine, Zacatecas, Mexico, 1906-1907; Consulting engineer, Mexico City, Mexico, 1908-1909; Consulting engineer, New York City, 1910. Present address unknown.
- LEON W. DUPUY** Los Angeles, California
Entered Freshman class 1916—.
- ETHAN J. EATON** Socorro, New Mexico
Entered Academic Department 1916—.
- ROBERT C. EATON** Socorro, New Mexico
Entered Academic Department 1916—.
- ALEXANDER WALTER EDELEN** Mexico City, Mexico
Student, 1905-1906. From Baltimore, Maryland. Assistant superintendent, Elkton Consolidated Mining & Milling Company, Elkton, Colorado, 1906-1907; Superintendent, Bonanza Mine, Zacatecas, Mexico, 1907-1908; Superintendent, American Smelting & Refining Company, Angangueouinit, Michiocan, Mexico, 1909—.
- THADDEUS BELL EVERHEART** Socorro, New Mexico
Student, 1905-1907. From Bells, Texas. Assayer and surveyor, Pereguina Mining and Milling Company, Guanajueto, Mexico, 1907-1908; Mill superintendent, Las Animas Mining and Milling Company, Pueblo Nuevo, Durango, Mexico, 1908-1910; Mining, Chloride, New Mexico, 1911-1913; Mining engineer, Socorro, New Mexico, 1914—.
- ERNEST L. FAHRENWALD** Socorro, New Mexico
Entered Academic Department 1916—.
- THOMAS ALBERT FERGUSON** San Diego, California
Entered Freshman class 1915—.
- LEOPOLD E. FLEISSNER** Milwaukee, Wisconsin
(B. S., E. M. in Mining Geology, New Mexico School of Mines, 1912.)
Student, 1910-1912. From Manistee, Michigan. Engineer, Sterling Engineering & Construction Company, Milwaukee, Wisconsin, 1912-1913; Engineer, Ray Consolidated Copper Company, Ray, Arizona, 1913—.
- CARL F. GERTZ** Los Angeles, California
Entered Academic Department 1916—.

HARRY THORWALD GOODJOHN

Torreon, Coahuila, Mexico

Student, 1902-1903. From Pittsburg, Texas. Assayer, Cia. Metalurgica de Torreon, Torreon, Coahuila, Mexico, 1903-1906; Chief chemist, Minera de Penoles Company, Mapimi, Durango, Mexico 1906; Chemist and metallurgist, Cia. Minera, Fundidora, y Afinadora, Monterey, Mexico, 1907-1908; Chief chemist, Cia. Metalurgica de Torreon, Torreon, Coahuila, Mexico, 1909—.

SAMUEL JAMES GORMLEY

West Jordan, Utah

Student, 1895-1896. From Mt. Vernon, Iowa. Assistant professor of Engineering, New Mexico School of Mines, 1895-1896; Assistant assayer, Anaconda Copper Mining Company, Anaconda, Montana, 1897-1900; Chemist, same company, 1900-1902; Superintendent of sampling works, Washoe Smelting Company, Anaconda, Montana, 1902-1906; Smelter superintendent, Bingham Copper & Gold Mining Company, West Jordan, Utah, 1906.

JOHN B. GUNTER

Belen, New Mexico

Entered, special student, 1914—.

EDWIN CLARENCE HAMMEL

Socorro, New Mexico

Entered Academic Department, 1912—.

HENRY HAYS

Estancia, New Mexico

Entered Academic Department, 1914—.

EDMUND NORRIS HOBART

El Paso, Texas

(B. S., New Mexico School of Mines, 1910.)

Student, 1906-1908; 1909-1910. From Clifton, Arizona. Chemist, Socorro Mines Company, 1909; Chief sampleman, Shannan Copper Company, Clifton, Arizona, 1910-1911; Assistant surveyor, American Smelting & Refining Company, Angangueo, Michiocan, Mexico, 1911; Resident engineer, Capistante Mines Group, Mazapil Copper Company, Limited, Concepcion del Oro, Zacatecas, Mexico, 1912; Chief engineer, Charcas Unit, American Smelting & Refining Company, Charcas, San Luis Potosi, Mexico, 1913-1914; Mining engineer, Phelps-Dodge Company, Morenci, Arizona, 1914; Mining engineer, El Paso, Texas, 1915—.

CARL JOHN HOMME

Marshfield, Oregon

(A. B., St. Olaf College,)

Graduate student, 1899-1900. From Wittenburg, Wisconsin. Assayer and chemist, Candelaria Mining Company, El Paso, Texas, 1900-1901; Assistant superintendent, Gulf Creek Mining Company, Gulf Creek, New South Wales, Australia, 1902; Assayer, Glendale, Oregon, 1909-1913; Dispatching clerk in post office 1915—.

WILLIAM ELIAS HOMME

Glendale, Oregon

(A. B., St. Olaf College)

....

Graduate student, 1902-1903. From Wittenburg, Wisconsin. Assayer, Gulf Creek Mining Company, Gulf Creek, New South Wales, Australia. 1903.

HAYNES A. POWELL

Santa Fe, New Mexico

Student, 1900-1905. From Socorro, New Mexico. Civil engineer on railway from Acapulco, Mexico, 1906-1907; Civil engineer, Mexican Central R. R., 1907-1912; Assistant to state engineer, Santa Fe, New Mexico, 1913—.

JOHN AUGUST HUNTER

Toledo, Ohio

(B. S., New Mexico School of Mines, 1903.)

Student, 1899-1903. From Socorro, New Mexico. Chemist, Consolidated Kansas City Smelting Company, El Paso, Texas, 1903-1904; Chemist and metallurgist, American Smelting & Refining Company, Aguascalientes, Mexico, 1904-1908; Metallurgist, Congress Mining Company, Congress, Arizona, 1909-1910; Assayer, Los Angeles, California, 1910-1911; Engineer, Pioneer Mining Company, Tucson, Arizona, 1911-1912; Engineer, American Zinc Ore Separator Company, Denver, Colorado, 1912-1914; Mining engineer, Socorro, New Mexico, 1914-1915; Engineer for Cananea Copper Company, 1916; Chemist for By-Product Plant, Toledo, Ohio, 1916—.

FRANK A. JOHNSTON

New Bloomfield, Pa.

Entered, 1911, from New Bloomfield, Pennsylvania. Secured B. S. degree in Civil Engineer, 1913.

RAY TOSHIMARO KANEOYA

Chiba, Japan

Entered Freshman class 1916—.

LEON WILLIAM KELLY

Montrose, Pennsylvania

Entered Junior class of Mining Engineering, 1915—.

CHARLES THAYER LINCOLN

New York, New York

(B. S., Massachusetts Institute of Technology, 1901.)

Graduate student, 1902-1903. From Boston, Massachusetts. Chemist, Bell Telephone Company, 1901-1902; Assistant in Analytical Chemistry, New Mexico School of Mines, 1902-1903; Acting professor, same, 1903-1904; Instructor in Chemistry, Iowa State University, Iowa City, Iowa, 1904-1905; Chemist, Hartford Laboratory Company, Hartford, Connecticut, 1905-1907; Chemist, Arbuckle Brothers Sugar Refinery, Brooklyn, New York, 1907-1909; Chemist, United States Custom Service, New York, 1910—.

FRANCIS CHURCH LINCOLN

Reno, Nevada

(B. S., Massachusetts Institute of Technology; E. M., New Mexico School of Mines, 1903.)

Assayer, San Bernardino Mining Company, 1900; Chemist, Butterfly Terrible Gold Mining Company, 1900-1901; Professor of Metallurgy, New Mexico School of Mines, 1902-1904; Assistant superintendent, Ruby Gold & Copper Company, Ortiz, Sonora, Mexico, 1904; General manager, Arizona Gold & Copper Company, Patagonia, Arizona, 1904; Professor of Geology, Montana School of Mines, Butte, Montana, 1907-1910; Consulting engineer, New York City, 1910-11; Assistant professor of Mining, University of Illinois. Urbana, Illinois, 1911-1913; Resident engineer,

Bolivian Dev. & Exp. Co., La Paz, Bolivia, 1913-1914; Director Mackay School of Mines, University of Nevada, 1914—.

HORACE T. LYONS

Globe, Arizona

(B. S. in Mining Engineering, New Mexico School of Mines, 1913.)

Mining engineer at Miami, Arizona, 1913-1914. Now at Ajo, Arizona, in moving picture theatre.

N. L. MACDONALD

Los Angeles, California

Entered Freshman class 1914—.

HARRY C. MAGOON

Chicago, Illinois

Student 1899-1900. From Chicago, Illinois. Engineer, Illinois Steel Company, Chicago, Illinois, 1911.

FRANK MALOIT

Tucson, Arizona

(B. S. in Mining Engineering, New Mexico School of Mines, 1914.)

Mining engineer at Lordsburg, 1914-1915; Assistant engineer of Xavier mine for Empire Zinc Company, 1916—.

HUGO MAREK

Clovis, New Mexico

Entered Freshman class 1916—.

JOHN B. McDONALD

Albuquerque, New Mexico

Entered Academic Department 1914—.

JOHN A. MCKINNON

Silver City, New Mexico

Entered Freshman class 1916—.

DANIEL M. MILLER

Lake Valley, New Mexico

(B. S., New Mexico School of Mines, 1909.)

Farming and stock raising at Lake Valley, New Mexico, 1916—.

TARVER MONTGOMERY

Santa Ana, California

Student, 1899-1900. From Santa Ana, California. County surveyor, Orange county, California, 1900-1901; Assistant engineer, Temescal Water Company, Corona, California, 1901; Transitman, San Pedro, Los Angeles & Salt Lake Railroad Company 1901-1902; Assistant engineer, Pacific Electric Railroad Company, Santa Ana, California, 1902.

WILLIAM ESTILL MOORE

Lexington, Kentucky

Entered Freshman class of Mining Engineering 1915—.

EARLE GIBBON MORGAN

Guadalajara, Jalisco, Mexico

(E. M., New Mexico School of Mines, 1911.)

Student, 1907-1908, 1910-1911. From Landsdowne, Pennsylvania. Pennsylvania State College, 1908-1910. Engineer, Socorro Mines Company, Mogollon, New Mexico, 1911-1912; Assistant engineer, same company, Guadalajara, Jalisco, Mexico, 1912—.

ERLE D. MORTON

Gold Circle, Nevada

(E. M. in Mining Geology, New Mexico School of Mines, 1909.)

Student, 1903-1905, 1908-1909. From Los Angeles, California. Assistant superintendent, Giroux Consolidated Mines Company, Kimberly, Nevada, 1905-1906; Washington University, 1906-1907; Mine ex-

aminer, Los Angeles, California, 1907-1908; Surveyor, Ampara Mining Company, Etzatlan, Jalisco, Mexico, 1908; Mine superintendent, Arizona & Nevada Copper Company, Luning, Nevada, 1909-1910; Mining engineer, Los Angeles, California, 1910; Chief engineer, Lone Mountain Tunnel Company, Superior, Montana, 1911-1912; with Braun Corporation, Los Angeles, California, 1912-1913; Assistant superintendent, Elko-Prince Mining, Gold Circle, Elko County, Nevada.

WILLIAM FREDERICK MURRAY

Gallup, New Mexico

Student, 1904-1906. From Raton, New Mexico. In chief engineer's office, Victor Fuel Company, Denver, 1906-1907; Assistant engineer, Victor Fuel Company, 1907-1908; Assistant to chief and traveling engineer, Victor Fuel Company and Colorado & Southern Railway Company, 1908; Assistant engineer, Hastings Mine, Victor Fuel Company, Hastings, Colorado, 1909-1910; Superintendent, Cass Mine, Victor American Fuel Company, Delagua, Colorado, 1910-1913; Assistant general superintendent, Victor-American Fuel Company, Gallup, New Mexico, 1913—.

HORATIO S. NOWAK

Milwaukee, Wisconsin

Entered Freshman class 1915—.

MARTIN J. O'BOYLE

Mogollon, New Mexico

(B. S. in Mining Engineering, New Mexico School of Mines, 1914.)

Mining engineer for the Socorro Mines Company, Mogollon, New Mexico, 1914—.

JOHN F. O'NEILL

San Diego, California

Entered Freshman class 1916—.

ORESTE PERAGALLO

Tepec, Mexico

(E. M., New Mexico School of Mines, 1908.)

Student, 1907-1908. From Ciudad Jaurez, Chihuahua, Mexico. Mining engineer, El Paso, Texas, 1908-1910; Graduate student, New Mexico School of Mines, 1910-1911; Mining engineer, El Paso, Texas, 1911-1912; Chemist, Tepec, Mexico, 1912-1914; Mining engineer, San Diego, California, 1915—.

PAUL PETERSON

Owatonna, Minnesota

Entered Freshman class 1916—.

EWIN PRATHER

Lake Arthur, New Mexico

Entered Freshman class 1916—.

DANIEL FRANCIS RECKHART

El Paso, Texas

Entered Freshman class 1913—.

ALBERT BRONSON RICHMOND

Tucson, Arizona

Student, 1900-1901. From Las Prietas, Sonora, Mexico. Superintendent, Ramona Mill Company, Gabilan, Sonora, Mexico, 1901-1902; Assayer, Patagonia Sampling Works, Patagonia, Arizona, 1902; Assayer and metallurgist, Patagonia, Arizona; General manager, Mans-

field Mining & Smelting Company, Patagonia, Arizona, 1908; Consulting engineer, Tucson, Arizona, 1909; Field engineer, Mines Company of America with headquarters at Tucson, Arizona, 1910—.

DELL FRANK RIDDELL Parral, Chihuahua, Mexico
(Ph. C., Chicago College of Pharmacy, 1896; B. S., Nebraska State University, 1901; E. M., New Mexico School of Mines, 1905.)

Graduate student, 1903-1905. From Sioux Falls, South Dakota. Professor of Chemistry, Sioux Falls College, Sioux Falls, South Dakota, 1901-1903; Instructor in Chemistry, New Mexico School of Mines, 1903-1904; Acting professor of assaying, same, 1904-1905; Holder of Allis-Chalmers Scholarship, 1905-1906; Engineer, Universal Pump & Manufacturing Company, Kansas City, Missouri, 1906-1907; Superintendent, Benito Juarez Mine, Parral, Chihuahua, Mexico, 1907-1908; Consulting engineer and acting superintendent, Providentia Mines Company, Parral, Chihuahua, Mexico, 1908.

SOREN RINGLUND Denver, Colorado
(B. S. and E. M. in Mining Geology, New Mexico School of Mines, 1912)

Student, 1910-1912. From Ceresco, Nebraska. Engineer, Empire Zinc Company, Kelly, New Mexico, 1912-1914; Mining geologist, New Jersey Zinc Company, 1915—.

ORLANDO DOUGLAS ROBBINS Depue, Illinois
(B. S. and E. M., New Mexico School of Mines, 1909.)

Student, 1905-1909. From Louisville, Kentucky. Chemist, El Chino Copper Company, Santa Rita, New Mexico, 1909-1910; Mill superintendent, Germania Mining Company, Springdale, Washington, 1910; Chief sampler, Inspiration Copper Company, Globe, Arizona, 1910; Engineer, United States Steel Company, Depue, Illinois, 1911-1913; Chief of ore and testing department of Mineral Point Zinc Company, Depue, Illinois, 1914—.

GEORGE L. ROSALES Lordsburg, New Mexico
Entered Academic Department 1916—.

JULIUS SANCHEZ Socorro, New Mexico
Entered Freshman Class 1912—.

MANUEL A. SANCHEZ Mora, New Mexico
Entered Sophomore class, Civil Engineering, 1914—.

CHARLES S. SHAMEL Seattle, Washington
(B. S., M. S., University of Illinois; LL. B., University of Michigan; A. M., Ph. D., Columbia University.)

Graduate student, 1901-1902. Mining lawyer, Seattle, Washington.

RAYMOND M. SHERIDAN Milwaukee, Wisconsin
Entered Freshman class 1916—.

JAMES AVERY SMITH Clifton, Arizona
Entered, 1908, from Socorro, New Mexico. B. S. degree in Metallurgical Engineering, 1913; Assayer and sampler, Inspiration Copper Com-

pany, Miami, Arizona, 1913-1916; on oil flotation, Smuggler Union Mine, Telluride, Colorado, 1916; Oil flotation engineer in California and at Clifton, Arizona, 1916—.

IRVING L. SMITH

Socorro, New Mexico

Entered Academic Department, 1913.

OLIVER RUSSELL SMITH

Naches, Washington

(B. S., Kansas College of Agriculture and Mechanic Arts, 1908;

C. E., New Mexico School of Mines, 1902.)

Graduate student, 1898-1901. From Manhattan, Kansas. B. S. in Civil Engineering, New Mexico School of Mines, 1902; Assistant in Mathematics and Draughting, New Mexico School of Mines, 1900-1901; Instructor in Engineering and Drawing, same, 1901-1902; Assistant professor in Engineering and Drawing, same, 1902-1903; Assistant surveyor, U. S. General Land Office, 1902; City engineer, Socorro, New Mexico, 1902; Deputy mineral surveyor, U. S. General Land Office, 1903; Professor of Civil Engineering, New Mexico School of Mines, 1903-1907; Civil engineer, Santa Fe Railway, San Bernardino, California, 1907-1908; Engineer United States Reclamation Service, Zillah, Washington, 1908-1910.

PAUL E. M. STEIN

El Paso, Texas

(B. S., New Mexico School of Mines, 1911; E. M. in Mining Geology, 1912.)

Student, 1907-1912. From Davenport, Iowa. Assistant engineer, Socorro Mines Company, Mogollon, New Mexico, 1912; Chemist, El Paso plant, Kansas City Consolidated Smelting and Mining Company, El Paso, Texas, 1912—.

EDWARD J. STEVENS

Pinos Altos, New Mexico

Entered Academic Department, 1914—.

KARL AKSEL STRAND

Kingston, New Mexico

(B. S. and E. M. in Mining Geology, New Mexico School of Mines, 1912.)

Student, 1906-1912. From Socorro, New Mexico. Ore classifier, Utah Copper Company, Garfield, Utah, 1912; Draughtsman, same, 1912-1913; Mine superintendent, New Jersey Zinc Company, Hanover, New Mexico, 1914; Mine engineering, same company, at Kingston, New Mexico, 1916—.

ALLIE STROZZI

Water Canyon, New Mexico

Entered Academic Department 1916—.

LEO RICHARD AUGUST SUPPAN

St. Louis, Missouri

(B. S. in Chemistry and Metallurgy, New Mexico School of Mines, 1896)

Student, 1895-1896. From St. Louis, Missouri. Instructor in Chemistry, New Mexico School of Mines, 1895-1897; Graduate student, Johns Hopkins University, Baltimore, Maryland, 1897; University of Warburg, Germany, 1898; Professor of Chemistry, Marine-Sims College, St. Louis, Missouri, 1898; Associate professor of Pharmaceutical Chemistry, St. Louis College of Pharmacy, 1913—.

CARL TISALL

Mount Marion, New York

Entered Freshman class 1916—.

OTTO JOSEPH TUSCHKA

Monterey, Nuevo Leon, Mexico

(E. M. in Metallurgical Engineering, New Mexico School
of Mines, 1897.)

Student, 1893-1897. From Socorro, New Mexico. Assayer and chemist, Graphic Smelting Works, Magdalena, New Mexico, 1897-1898; Graduate student, New Mexico School of Mines, 1898-1899; Assistant sampling mill foreman and chemist, Guggenheim Smelting & Refining Company, Monterey and Aguascalientes, Mexico, 1899-1900; Assayer, Seamon Assay Laboratory, El Paso, Texas, 1900; Chief chemist, Compania Minera, Fundidora, y Afinadora, "Monterey," Monterey, Nuevo Leon, Mexico, 1900—.

LAURENCE P. WELD

Thompson, Nevada

(B. S. and E. M., New Mexico School of Mines, 1912.)

Student, 1908-1912. From Rochester, New York. Concentrator man, Original Amador Mines Company, Amador City, California, 1912-1913; Assistant engineer and chemist, same company, 1913; Smelter electrician, Mason Valley Mines Company, Thompson, Nevada, 1913—.

MILTON BENHAM WESTCOTT

Monterey, Nuevo Leon, Mexico

Student, 1904-1905. From Chicago, Illinois. Engineering corps, Santa Fe Railway, 1905; Assistant county surveyor, El Paso county, Texas, 1906-1907; Assistant engineer Monterey Railway, Light and Power Company, Monterey, Nuevo Leon, Mexico, 1907; Assistant engineer, Monterey Water-works and Sewer Company, Monterey, Nuevo Leon, Mexico, 1907, 1908; Resident engineer, same, 1908—.

GLENN H. WICHMAN

Los Angeles, California

Entered Freshman class 1916—.

WAKELEY A. WILLIAMS

Grand Forks, British Columbia, Canada

Student, 1893-1894. From Council Bluffs, Iowa. Assistant superintendent, Granby Consolidated Mining, Smelting, and Power Company, Limited, Grand Forks, British Columbia, Canada, 1898. At present superintendent of same.

FOREST WINGFIELD

Alamogordo, New Mexico

Entered Freshman class 1916—.

OICHIRO YAMAMOTO

Tokyo, Japan

Entered as special student 1916—.

JAMES YATES

Gallup, New Mexico

Entered Freshman class 1916—.

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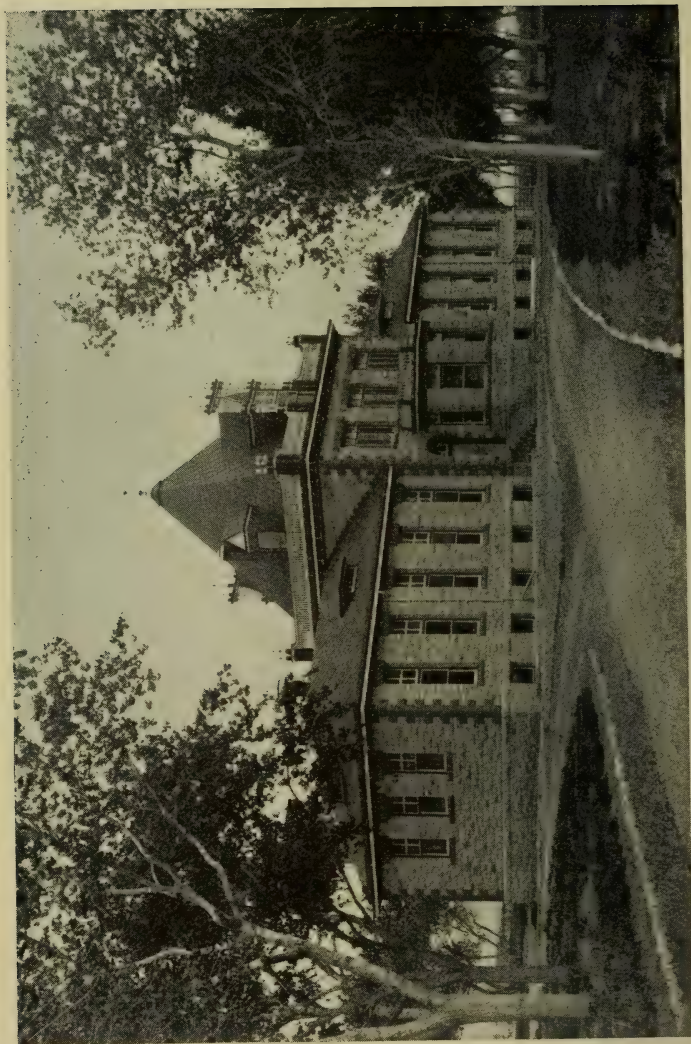
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NEW MEXICO
STATE
SCHOOL OF MINES
SOCORRO, N. M.



1917 - CATALOG - 1918

With Announcements for 1918-1919



MAIN BUILDING

NEW MEXICO
STATE
SCHOOL OF MINES

SOCORRO, N. M.



1918 - CATALOG - 1919

With Announcements for 1918-1919



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JANUARY

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SCHOOL CALENDAR

1918

First Semester:

September 16, Monday—Registration of students.

September 17, Tuesday—Class work begins.

November 28, Thursday—Thanksgiving.

December 21, Saturday—Holiday recess begins.

1919

January 2, Thursday—Work resumed.

January 20, 21, 22, 23, 24—Examinations.

Second Semester:

January 27, Monday—Second semester begins.

February 22, Washington's Birthday—Holiday.

May 15, 16, 19, 20, 21—Final examinations.

May 22, Thursday—Commencement.

BOARD OF REGENTS

P. H. ARGALL, <i>Manager Ozark Sm. and M. Co.</i>	Magdalena
J. M. SULLY, <i>Manager Chino Copper Co.</i>	Hurley
C. T. BROWN, <i>S. W. Supt. The Empire Zinc Co.</i>	Socorro
W. A. PARVIS, M. D.....	Socorro
C. C. CLARKE, D. D. S.....	Socorro

The complete Board is as follows:

HIS EXCELLENCY, G. W. LINDSEY, <i>Governor of New Mexico, ex-officio</i>	Santa Fe
HON. J. H. WAGNER, <i>Superintendent of Public Instruction, ex-officio</i>	Santa Fe
P. H. ARGALL.....	Magdalena
J. M. SULLY.....	Hurley
C. T. BROWN.....	Socorro
W. A. PARVIS, M. D.....	Socorro
C. C. CLARKE, D. D. S.....	Socorro

OFFICERS OF THE BOARD

P. H. ARGALL.....	President
C. T. BROWN.....	Secretary and Treasurer
MRS. BLANCHE REED.....	Clerk of Board

FACULTY

ALEXIS XAVIER ILLINSKI...*President and Professor of Chemistry*

B. S. in Chemistry and Metallurgy, School of Mines and Metallurgy, University of Missouri, 1909; Met. E., School of Mines and Metallurgy, University of Missouri, 1916; Superintendent of Underground Diamond Drills, Federal Lead Company, Flat River, Missouri, 1906-7; Superintendent of Canvas Plant, Federal Lead Company, Flat River, Missouri, 1907-8; Chemist, Missouri Geological Survey, Rolla, Missouri, 1909-12; Instructor in Metallurgy and Ore Dressing, School of Mines and Metallurgy, Rolla, Missouri, 1912-14; Experimental Research Station, School of Mines and Metallurgy, Rolla, Missouri, 1914-15; Professor of Chemistry, New Mexico State School of Mines, 1915-17; President and Professor of Chemistry, New Mexico State School of Mines, 1917—

EDGAR HERBERT WELLS...*Professor of Geology and Mineralogy*

E. M. University of North Dakota, 1909; Assistant Engineer, Daly West Mine, Park City, Utah, 1909; Mining and leasing operations, Daly West and Daly-Judge Mines, Park City, Utah, 1910-11; Engineer and Draftsman, Canadian Collieries (Dunsmuir) Ltd., Cumberland, B. C., 1912-14; Instructor in Mathematics, Geology, Mineralogy and Physical Education, Tintic Mining High School, Eureka, Utah, 1914-16; Instructor in Mathematics and Physical Education, West Side High School, Salt Lake City, Utah, 1916-17; Assistant Superintendent, Austin-Dakota Mining Co., Austin, Nevada, 1917; Professor of Geology and Mineralogy, New Mexico State School of Mines, 1917—

RICHARD HERB REECE...*Professor of Mathematics and Physics*

B. S. in Electrical Engineering, Kansas State Agricultural College, 1906; Graduate student at University of Wisconsin, 1916; Telephone Engineer with Western Electric Co., Chicago, 1906-08; Principal of High School, Champion, Mich., 1908-10; Instructor in Mathematics, Michigan Agricultural College, 1910-17; Professor of Mathematics and Physics at the New Mexico State School of Mines, 1917—; Member of the Mathematical Association of America.

CHARLES LESLIE NICHOLS.....*Professor of Civil Engineering*

B. Sc. in Mathematics, Franklin College of Indiana, 1907; M. Sc. in Civil Engineering, Nebraska University, 1916; Student in Civil Engineering, Purdue University, 1908-10; Department of General Science, Lincoln High School, Lincoln, Nebraska, 1910-14; Structural Draftsman, Paxton Vierling Iron Works, Omaha, Neb., 1912; Assistant Engineer, Street and Pavement Department, City of Los Angeles, 1914; Department of Mathematics and Surveying, Citrus Union Junior College, Glendora, Calif., 1915-16; Professor of Civil Engineering, New Mexico State School of Mines, 1917—

BYRON JOHN SNYDER.....*Professor of Mining and Metallurgy*

B. S. in Chemistry and Metallurgy, School of Mines and Metallurgy, University of Missouri, 1907; Met. E., School of Mines and Metallurgy, University of Missouri, 1910; Assistant in Chemistry, Missouri School of Mines and Metallurgy, 1904-06; Instructor in Chemistry, Missouri School of Mines and Metallurgy, 1907-08; Chemist Research and Analytical Laboratory, Mallinckrodt Chemical Works, St. Louis, Mo., 1908-10; Director of Mining Department and Professor of Mining Engineering and Metallurgy, North Georgia Agricultural College, University of Georgia, 1910-17; Professor of Mining and Metallurgical Engineering, New Mexico State School of Mines, 1917—

JOHN BUCHANAN GUNTER.....*Principal Academic Department*

B. Pd., New Mexico Normal School at Silver City, 1911; Principal of Public School, San Marcial, N. M., 1911-12; Instructor in New Mexico Normal School (summer sessions), 1911 and 1913; M. Pd., New Mexico Normal at Silver City, 1913; Superintendent of Public Schools at Belen, N. M., 1912-14; Principal Academic Department, New Mexico State School of Mines, 1914—

JOHN A. MCKINNON.....*Instructor in Spanish***RAY C. AHNEFELDT*Instructor in Shop*****MRS. BLANCHE REED.....*Registrar and Librarian***

ORGANIZATION

The New Mexico State School of Mines includes the College of Engineering and the Academy.

COLLEGE OF ENGINEERING

In the College of Engineering the following courses are offered:

1. Mining Engineering.
 2. Metallurgical Engineering.
 3. Geological Engineering.
 4. Civil Engineering.
-

THE ACADEMY

The Academy offers instruction in subjects required for entrance to the College of Engineering.

NEW MEXICO STATE SCHOOL OF MINES

HISTORICAL SKETCH

The New Mexico State School of Mines was founded by Act of the Legislature of 1889. The Act provided for the support of the School by an annual tax of one-fifth of a mill on all taxable property.

Under an Act of the Legislature, approved February 28, 1891, a board of trustees was appointed. Organization was effected and immediate steps were taken towards the erection of necessary buildings. In the same year a special appropriation of \$4,000 was made for the partial equipment of the chemical and metallurgical laboratories.

Early in 1892 a circular of information regarding the New Mexico School of Mines at Socorro, New Mexico, was issued by the Board of Trustees. In this circular the aims of the institution were fully set forth. The following year a president was chosen and students in chemistry were admitted; but it was not until the autumn of 1895 that the mining school was really opened.

In 1893 a second special appropriation of \$31,420 was made to enable the School of Mines to be organized in accordance with the policy outlined by the Act creating the institution.

By Act of Congress, approved June 21, 1895, the New Mexico School of Mines received for its share of certain grants of land fifty thousand acres for its support and maintenance. From this source of revenue the school has already received more than \$40,000.

In 1899 the Legislature increased the former levy of one-fifth of a mill to twenty-seven and one-half one-hundredths of a mill.

In 1901 the Thirty-fourth General Assembly recognized the growing importance of the School by further increasing the tax levy to thirty-three one-hundredths of a mill. It also authorized

the bonding of any portion of the grants of lands in order to more thoroughly equip the School with buildings and apparatus.

In 1903 the Thirty-fifth General Assembly raised the millage to forty-five one-hundredths of a mill. This, with greatly increased assessed valuation of property, doubled the income of the school over that of the previous year.

Since 1903 the appropriation for the support and maintenance of the School of Mines has been increased at each session of the General Assembly. At the first session of the State Legislature the appropriation was raised to \$22,500 a year.

The Second State Legislature of 1915 provided the additional fund of \$20,000 for machinery and metallurgical and ore dressing equipment.

By the terms of the Enabling Act under which New Mexico was admitted to statehood, the School of Mines becomes possessed of an additional 150,000 acres of land. Most of this land has now been selected and will soon become the source of a very considerable revenue to the institution.

STATUTES RELATING TO THE SCHOOL

Some of the sections of the Act creating the School of Mines are as follows:

The object of the School of Mines created, established and located by this Act is to furnish facilities for the education of such persons as may desire to receive instruction in chemistry, metallurgy, mineralogy, geology, mining, milling, engineering, mathematics, mechanics, drawing, the fundamental laws of the United States and the rights and duties of citizenship, and such other courses of study, not including agricultural, as may be prescribed by the Board of Trustees.

The management and control of said School of Mines, the care and preservation of all property of which it shall become possessed, the erection and construction of all buildings necessary for its use, and the disbursement and expenditure of all moneys appropriated by this Act, or which shall otherwise come into its possession, shall be vested in a board of five regents, who shall be qualified voters and owners of real estate; and said regents shall possess the same qualifications, shall be appointed in the same way, and their terms of office shall be the same, vacancies

shall be filled in like manner, as is provided in Sections 9 and 10 of this Act. Said regents and their successors in office shall constitute a body under the name and style of "The Board of Regents of the New Mexico School of Mines," with right as such of suing and being sued, of contracting and being contracted with, of making and using a common seal and altering the same at pleasure, and of causing all things to be done necessary to carry out the provisions of this Act. A majority of the board shall constitute a quorum for the transaction of business, but a less number may adjourn from time to time.

The immediate government of their several departments shall be intrusted to the several faculties.

The board of regents shall have power to confer such degrees and grant such diplomas as are usually conferred and granted by other similar schools.

The regents shall have power to remove any officer, tutor or instructor or employe connected with said School when, in their judgment, the best interests of said School require it.

The board of regents shall require such compensation for all assays, analyses, mill-tests, or other services performed by said institution as they may deem reasonable, and the same shall be collected and paid into the treasury of the School of Mines for said institution, and an accurate account thereof shall be kept in a book provided for that purpose.

LOCATION

The New Mexico State School of Mines is located at Socorro, the county seat of Socorro County, on the main line of the Atchison, Topeka and Santa Fe Railway, 75 miles south of Albuquerque, and 180 miles north of El Paso. The Magdalena branch of the Santa Fe railway starts from this place.

Socorro is situated in the valley of the Rio Grande at the foot of the Socorro range of mountains at an elevation of 4,600 feet above the level of the sea. The surrounding scenery is diversified by plains, valleys, mesas, hills, and mountains. The climate of the locality is preeminently pleasant and healthful, and has long attracted health-seekers who would escape the rigors of less favored localities. The air is exceedingly dry and the temperature is mild and equable. Socorro's public water supply comes

from warm springs that issue from Socorro mountain three miles away. The water is famed for its purity and has always been an attraction to visitors and residents.

The ground immediately adjacent to the School of Mines includes irrigable land, plateaus and mountain formations, all affording an excellent field for practice in surveying, the laying out of railroads and irrigating canals, topography, mine engineering and geology, so that students can be prepared at the very door of the school in those branches which usually require tedious excursions from most other schools.

The New Mexico State School of Mines enjoys the natural advantage of being located in the midst of a region peculiarly rich in minerals of nearly all kinds, and is within easy reach of the most varied geological conditions, all of which are within a radius of thirty or forty miles of Socorro. The industrial processes connected with mining and metallurgy may be seen admirably illustrated at Mogollon, Kelly, White Oaks, San Pedro, Hillsboro, Lordsburg, Fierro, Silver City, Pinos Altos, Santa Rita, Burro mountains, Hurley, El Paso, Los Cerrillos, Dawson, Gallup, Carthage, and elsewhere within easy reach of the School. These illustrate the most modern methods of mining, milling, ore-dressing, concentrating, lixivation, cyaniding, and other metallurgical processes.

A number of mines of various kinds, smelters, irrigation systems, and other engineering works are accessible to the School. Within a few hours ride by rail are many important mining camps. The longer excursions bring the student to some of the most famous mines in southwestern United States. Some of the oldest worked lodes in America are in this region. Gold and turquoise were first noted by the *conquistadores* in 1540-2 by the celebrated expedition of Francisco Vasquez de Coronado, when in search of the Gran Quivera, one of the seven cities of Cibola. The first modern discovery of gold west of the Mississippi was made in New Mexico at the base of the Ortiz mountains, in Santa Fe county, in the year 1828. The first copper mined west of the Mississippi river was at Santa Rita in Grant county, in 1800. The metal from these copper mines was transported on the backs of burros to Mexico City and thence sent to the royal

mint of Spain to be made into coin. The Chino Copper Company now operates these celebrated mines. Among the great wonders of the West are the ancient turquoise workings at Mount Chalchihuitl near Los Cerrillos. An ancient lode mine, known as *Mina del Tierra*, is situated near the ancient turquoise workings.

The history of modern mining schools shows that each becomes most celebrated along the line for which its locality is best known on account of its natural surroundings. Few institutions of learning are more dependent for success upon what may be called the accident of geographical location. It may be truthfully said that few mining schools are more fortunately situated so far as natural environment is concerned than that of New Mexico.

BUILDINGS AND GROUNDS

The Campus

The State School of Mines campus contains 32 acres of nearly level ground on the outskirts of the city of Socorro. Groves of trees have been planted and trees line the walks and drives.

Main Building

The main building consists of three stories and a good basement. It is T-shaped, 135 feet long by 100 feet deep, the central rear wing being 54x32 feet. It is constructed in a very substantial manner of a beautiful gray granite in broken ashler and is trimmed with Arizona red sandstone.

The building is handsomely finished throughout. It is well ventilated, heated with a good hot-water system, piped for water and gas, and wired for electricity for illumination and for experimental purposes.

As now arranged the main floor of this building contains the president's office, the mineralogical museum, the qualitative chemical laboratory and instructor's office, the assay laboratory and balance rooms, and a lecture room. The basement contains two lecture rooms, the physical laboratory, and instructor's private mineralogical laboratory, the quantitative chemical laboratory, the electro-chemical laboratory, an instructor's private chemical laboratory, the chemical supply rooms, a photographic dark room, the hot water heating plant, and the lavatory. A lecture room, now occupied by the department of mathematics, is located on the second floor. The main library occupies the third floor.

Engineering Building

The new engineering building is built in the shape of a Greek cross, 60 feet wide by 120 feet long, and 24 feet in height. It is of steel and concrete, with concrete roof, steel sash and heavy 3-ply tin doors; making the building entirely fire proof. There are 11 steel monitor type trusses in this building six of 30-foot

spans each, and five of 40-foot spans each. The trusses being carried on steel columns and the panels between the columns filled in with steel studdings and girders to which are fastened heavy metal hy-rib. The building is plastered inside and out with cement. The monitor is about 10 feet wide and has a 3-foot top hung steel sash along both sides along the wings. The overhead sash serve also as ventilators being operated below by an endless chain passing over a pulley which in turn operates a worm gear. Heavy re-inforced window lights are used throughout the building. This system of lighting diffuses the light so that all parts of the building are equally well lighted.

Power Plant

The new power plant building is constructed of re-inforced concrete. The building is 34 feet long, 24 feet wide and 18 feet high. It is well lighted by 14 windows, each 4x6 feet, having heavy reinforced glass. The structure is absolutely fire proof. The building is one of the most attractive structures on the grounds.

Ore Dressing and Treating Plant

The building housing the machinery of this plant is a temporary building and is 50x40 feet in size, two stories high. This building is sufficiently large and well lighted for carrying on the work of the School at the present time. It is intended within a few years to erect a permanent and larger building for carrying on the metallurgical operations.

Dormitory

As a result of the generous appropriation of \$15,000 by the territorial legislature, the School of Mines is in possession of an excellent dormitory. The building is heated with hot water and lighted with electricity. There is a dining room and a kitchen in connection, also a bath room on each of the two floors and a shower bath in the basement. On the main floor is located the boys' club room. The building is designed to afford accommodations for about thirty students.

LABORATORIES AND EQUIPMENT

Chemical Laboratories

The chemical laboratories as now arranged occupy the entire south wing of the main building, while the store room, private laboratory, and chemical lecture room are located in the central section of the same building. Elements of chemistry and qualitative analysis are taught in the large laboratory on the main floor. The room, which is exceptionally well lighted and ventilated, is equipped with large hoods, a balance room, and twenty-four desks, each of which is supplied with gas, water, and electric light.

The basement laboratory is fitted with large windows, glass partitions, and modern desks. The east half of it is used for quantitative analysis and wet assaying. There are large hoods in each end which are supplied with hot plates and drying ovens, while each desk is equipped with an Alberine stone sink, water, gas, and electric lights.

In the west half of the basement there are the instructor's laboratory, electro-chemical laboratory, and balance room. The latter is fully equipped with the best analytical balances supported upon a solid concrete table which is entirely free from vibration. The electro-chemical laboratory is supplied with current from a modern storage battery plant, consisting of a motor-generator, storage cells, and a switch-board so arranged that each student may obtain any current he desires for analytical or other electro chemical experiments. There is also a supply of alternating current from the city circuit which may be used for light and for the small electric furnaces, in case of an accident to the School of Mines plant.

The laboratory is very completely equipped not only with all apparatus, chemicals, and supplies needed for the various courses, but the stock includes a large amount of pure chemicals and special apparatus, including standardized burettes, flasks,

and weights which are used for the most accurate rock analysis and research work.

All apparatus is loaned to the students. Chemicals and supplies are furnished at cost.

Assay Laboratory

The assay laboratory occupies the main floor and basement of the west wing of the main building. The furnaces are all new and include muffle gasoline blow-pipe furnaces of different types and large muffle coal and coke furnaces. This department is conveniently arranged with shelving, drawers and boxing for fluxes, and other assaying materials and supplies.

A weighing room containing a number of Becker's balances is conveniently located between the furnace-room and the lecture-room. In the grinding room, which is in the basement, there are various types of laboratory machines for carrying on experimental work.

Physical Laboratory

The physical laboratory occupies the east side of the north basement of the main building and contains the usual apparatus for illustrating the facts and laws of physics. In addition there has just been added at a considerable expense all the apparatus necessary to perform the quantitative experiments outlined in Courses 201 and 202 in the Department of Physics.

Petrographical Laboratory

For the microscopic study of rocks both in elementary and advanced or graduate work the School is well supplied with rocks in thin sections representing the various types of igneous, metamorphic, and sedimentary rocks accompanied by hand specimens, giving the student an opportunity to study the microscopic and megascopic characters of the rocks at the same time. The laboratory is well equipped with standard up-to-date microscopes with all accessories; also, a camera for microphotographic work with accessories for oblique and vertical illumination; also a Sauveur and Boylston polishing machine with electric power attachment where the students in petrography are taught how to make and mount thin sections and prepare polished surfaces of the opaque minerals.

Mineralogical Laboratory

For the study of minerals by physical characters and blow pipe test, the School is especially well provided with an abundance of material of various ores and minerals for blow pipe determinations. Large collections for this purpose have recently been added to the School and the minerals are so arranged that no two students work with the same minerals the same day, thereby stimulating thorough systematic search for the elements and correct determination of the mineral specimens. The laboratory is well equipped with all necessary apparatus to carry on this work in an efficient and up-to-date manner.

Mineralogical Museum

The Mineralogical Museum, with instructor's office, occupies the center north wing of the first floor of the main building. The School owns a very fine collection of minerals and rocks of all kinds. These are arranged systematically, forming units for the various courses in geology rather than for showy display. The minerals and rocks from the various mining districts are segregated, thereby giving the student the best possible opportunity of studying the ores and rocks of a district without having actually visited the field. The Museum is well supplied with such district collections throughout the United States, Mexico, and Canada. New specimens are being added from time to time.

Electrical Equipment

The equipment of the power plant consists of two semi-Diesel Fairbanks-Morse Company engines. The smaller of the two engines delivers about 15-horse power at full load, and is belted to an air compressor and also to a direct current dynamo. The compressor is used to store air in two cylindrical reservoirs at a pressure of 120 pounds per square inch for starting the larger engine. The fuel oil used by these engines may be any crude heavy oil or distillate. The larger engine is controlled by an inertia governor on the main shaft and varies the supply of oil according to the speed. The cylinder is lubricated by forced feed. The larger of these two engines is intended to furnish most of the power on the campus. It is of the vertical type and runs with very little vibration. The top of the cylinder is about

eight feet above the base of the engine. The fly wheel is about seven feet in diameter and weighs nearly five tons. It is mounted between the vertical engine and the alternating current engine which furnishes power to the various buildings. The alternating current generator gives a 3-phase current, so that either 3-phase or single phase motors may be used in the various buildings. The larger engine and alternator will deliver 37.5 kilowatts at 440 volts when run at 257 revolutions per minute. The current is about 47 amperes per phase at full load. The field coils of the alternator are excited by means of a generator, which is run from the main shaft of the larger engine. The generator can deliver 40 amperes and 125 volts when run at 1250 revolutions per minute. The direct current dynamo connected with the smaller engine will deliver 60 amperes at 125 volts when run at 1250 revolutions per minute. The frequency of the alternating current at the rated speed of the larger engine is 60 cycles per second.

There are two switch boards, one for the alternating current power circuits and one for the direct current power circuits. The former was designed and constructed by the Westinghouse Electric Company, and the latter by the General Electric Company. The former contains three panels; an exciter panel, a generator panel, and a feeder panel. There are thirteen ammeters and volt-meters mounted on these panels, together with a three-phase watt meter. All switches are used in the main alternating current circuit and in the various feeding lines, which run to the 3-phase and single phase meters. It is possible to see at a glance the amount of current that is being used on these branches and the total amount of power that is being used on all the motors.

The voltage of each phase can also be measured. Current transformers are used in connection with the 3-phase watt meter. There are the usual arrangements for detecting grounds. The switch board also provides for the installation of an additional similar power unit to run in synchronism with the present unit.

Mechanical Equipment

The following equipment for the new engineering building has just been installed, to-wit

One wood-turning lathe, 12x36 inches, with outside face plates, floor stand and rest.

Two similar but smaller lathes, 12x24 inches.

One planer, 24x6 inches.

One joiner, 9 inches.

One band-saw, 30 inches.

One hand-trimmer, 15x5 inches.

One saw-table.

One improved oilstone grinder.

All of these machines are direct-connected with A. C. motors.

For the new draughting room there has been installed:

Twenty drawing tables, 33x60 inches, with drawers for instruments and materials.

Twenty stools with adjustable screw bottoms.

One five-section filing cabinet, large size.

EXPERIMENTAL FLOTATION PLANT.

The Chino Copper Company, of Hurley, New Mexico, of which Mr. John M. Sully is manager, has generously donated to the New Mexico School of Mines a complete two-ton experimental flotation plant consisting of one jaw crusher, one plunger feeder, one ball mill, one Wilfley table, two elevators, three Callow cells and three Janney flotation machines, together with the necessary shafting and drive pulleys.

The machinery will be installed during the balance of the school year and the coming summer so that it may be had for use when the students return in September. This equipment will make it possible to carry on experiments on sufficiently large portions of ore to make the student's work of great practical value to him.

ENGINEERING INSTRUMENTS

The Civil Engineering Department has all the instruments necessary for land, railroad, irrigation, mine, and topographic surveying. These include chains, tapes, range-poles, leveling rods, wye and dumpey levels, complete transits, and plane tables.

In purchasing instruments for this department only the best grade has been considered and the student has the opportunity to become familiar with the product of such well known manufacturers as W. & L. E. Gurley, Eugene Dietzgen, Buff & Buff, etc.

The engineering department has recently purchased a new modern Gurley light mountain transit of the type, 27 A. The instrument has an auxiliary detachable telescope for use in mine shaft surveying.

Draughting Room

A spacious, well-lighted draughting-room is provided in the mechanical building. Opening off from it are the instructor's office, supply-room, blue-print room with large printing frame, developing-vat, and drying rack.

A drawing table is furnished each student. There are private spaces for his materials and instruments. An Ingersoll-Rand drill and other pieces of machinery are used as models.

LIBRARIES

The libraries of the New Mexico School of Mines consist of a general library and department libraries.

In the main library are the works of reference, the encyclopedias, dictionaries, journals, magazines, proceedings of the learned societies, periodical issues of other colleges, reports of federal, state and foreign surveys, official maps, plats, and atlases, and volumes on history, travel, and philosophy.

The following periodicals and publications are received by the School:

Engineering and Mining Journal.

Mining and Scientific Press.

Power.

Engineering News Record.

Chemical and Metallurgical Journal.

Journal of the American Chemical Society.

Journal of Industrial and Engineering Chemistry.

Chemical Abstracts.

Economic Geology.

Journal of Geology.

Transactions of the American Institute of Mining Engineers.

All the U. S. Geological Survey Publications.

U. S. Bureau of Mines Publication.

Canadian Geological Survey Publications.

Various daily and weekly papers.

Libraries are located in the several departments of the School. These are essentially working libraries. They consist of carefully chosen treatises, text-books, monographs, and special contributions pertaining to the respective divisions.

Powell Library.—The School has come into possession of the private library of the late Major John W. Powell of Washington, D. C., who for many years was director of the United States Geological Survey. The collection embraces several thousand titles. The volumes are chiefly works on mining, geology, philosophy and many rare monographs of great practical value. Especially well represented is the literature relating to the Rocky Mountain region and the great Southwest. It was in these fields that Major Powell did most of his work which has had such an important influence on the development of the mining industry. It therefore seems particularly fitting that the library of this famous man, who has been so long identified with this western country, should find a permanent home in New Mexico.

SOCORRO MOUNTAIN MINES

The silver mines at the base of Socorro Mountain, only about two miles west of the School campus, afford excellent opportunity for the practice of mine-surveying and for a study of some features of practical mining. The ore-bodies with associated geological structures and many other features will interest the student of mining and geological engineering.

PURPOSE

The ideal to which the New Mexico State School of Mines tenaciously holds is the practical directing of young men to take active part in the development of the mineral wealth of the world.

The School is a state institution. It was established primarily to promote the development of the mineral resources of New Mexico and to provide facilities for the young men of the state to secure a practical education in all departments of mining. Naturally, however, the institution's field of usefulness has steadily grown broader. Not only New Mexico, but also other parts of the Southwest have felt its influence through its graduates in the development of the mining industries of this great region. Moreover, a considerable number of students from other parts of the country who desired to avail themselves of the peculiar advantages of this region have come to the School of Mines for the training they needed and the number of such young men is constantly increasing.

During the entire period of his training the fact is impressed upon the mind of the student that intelligent mining is a business operation capable of being put on as secure a foundation as any other; that from beginning to end it is akin to all other great business undertakings.

ADVANTAGES

Several features contribute to the success of this institution as a school of mines: .

The unique natural surroundings of the School already described create an invigorating mining atmosphere which is entirely wanting in institutions remote from the mines and mountains.

In the training offered by the School there is noteworthy concentration of effort. There are many advantages in specialization along few lines. In contrast with the many diversions that necessarily exist in those technical institutions of learning where all practical branches are equally represented, singleness of

purpose is a leading feature of the New Mexico State School of Mines. The concentration of energy growing out of the special method of instruction happily adapts the student so that he gets the most out of his labors.

The student is expected as an integral part of his course to visit and critically inspect, under the direct supervision of his instructors, various plants and works and to make intelligent reports. Being obliged from the start to make the most of the exceptional opportunities presented, he quickly falls into the spirit of his present and future work and at once necessarily acquires for his chosen profession a sympathy that is seldom attained, except after school days are over and after long and strenuous effort.

Being within short distances of mines and smelters, the student has the opportunity of finding regular employment during his vacation and of acquiring desirable experience in practical work.

The field for scientific research in New Mexico is unrivalled and the opportunities here offered are not neglected in the plan and scope of instruction. New Mexico is perhaps less known geologically than any other section of the United States. A little study of the plateau region of the northwestern portion of the state has been made by the United States Geological Survey, but only in a general way. No attempt has ever been made under government auspices to investigate closely the geological structure of New Mexico mountains such as have been carried out in the other Rocky Mountain states, or to study the conditions of New Mexico mineral deposits as has been done in Colorado by Emmons, in Nevada by Curtis, in California by Becker, and in other states by other distinguished investigators.

Much of the advanced professional work of the School is of an original nature to the end that the graduates may be skilled, theoretically and practically, in the very problems which they as professional men will be called upon to solve. This work is carried on by the advanced students under the direction of the professors and involves the collection of notes, sketches, maps, and specimens, and the results of directed observations in all matters relating to the sciences and arts embraced in the courses of study. The subjects for such researches in geology and mining in the

reduction of the ores of lead, silver, gold, copper, and zinc are so numerous that it is impossible to do more here than to mention the fact that the conditions of climate, drainage, water-supply, and geological structure in New Mexico differ greatly from the conditions existing in other parts of the Rocky Mountains, thus giving rise to new problems in practice. These problems are not by any means all that deserve attention. The investigations of the ores of iron, manganese, aluminum, cobalt, nickel, tin, quicksilver, vanadium, and uranium, together with the beds of coal, salt, alum, building stones, mineral-paints, cement-rock, marls, etc., are directly in line with the advanced laboratory work of the School. Work of this character on the part of the students is encouraged in every possible way.

ADMINISTRATION

The general management of the New Mexico State School of Mines is vested in a Board of Regents consisting of five members appointed by the Governor of the State with the concurrence of the Senate for a term of four years. The Board of Regents elects a president from its members and also a secretary and treasurer. The appointment of a president and other members of the faculty and teaching staff is made by them.

By Act of the Legislature, the maintenance of a preparatory department is required of the higher educational institutions of the state. The New Mexico State School of Mines, therefore, is composed of the College and the Academy.

THE COLLEGE OF ENGINEERING

ADMISSION

Applicants for admission to the College should arrange to be present the first day of the school year. In 1918 the College opens September 16th and students will register on that day.

Admission by Certificate

Graduates of approved high schools of this and other states or of other schools offering equivalent training will be admitted to the regular four-year courses without examination, provided their certificate of graduation shows that they have included in their preparatory work the following subjects: Algebra, to and including quadratic equations; Plane Geometry, one year; Solid Geometry, one-half year, and Elementary Physics, one year.

If applicant is deficient in one or two of the subjects specified above he may be admitted conditionally. The Academy offers opportunity for the removal of such conditions and all students thus admitted will be expected to remove their conditions during their Freshman year.

Admission by Examination

Candidates for admission who cannot show a certificate of graduation from an approved preparatory school will be required to stand examination in the following subjects: English, Algebra, Plane and Solid Geometry and Physics. The results of these examinations will be presented to the faculty and with their consent the applicant may enter the school. All students admitted by this method will be expected during their first semester to show that they are capable of pursuing with success, work of college character.

Admission on Advanced Standing

Students desiring to enter this college on credits from other institutions should present a copy of their credits, together with letter of honorable dismissal, to the President of the College.

This College is willing to give credit for work done in other recognized institutions in so far as it applies upon our courses of study. The amount of credit given for any subject is determined by the department in which similar work is offered.

Special Students

Students are urged to enter a regular course and take the work as outlined. Students not candidates for a degree are given special classification only when the age and preparation of the applicant, in the judgment of the President, seems to render such action necessary.

Registration

No student will be allowed to register for any subject until the pre-requisites are credited to him on the school records. Therefore the student is advised not to delay either in making up any deficiencies which may exist or in obtaining the credits which may be due him for work done elsewhere.

DEGREES

This institution confers two classes of degrees: First, the Bachelor of Science degree at the completion of one of the prescribed four-year courses; and second, the degree of Engineer of Mines, Metallurgical Engineer, Geological Engineer, or Civil Engineer upon compliance with certain additional requirements.

The degree of Bachelor of Science in Mining Engineering, Metallurgical Engineering, Geological Engineering, or Civil Engineering is conferred upon those who, as students of the institution, have completed the corresponding prescribed courses of any one of the several curricula. This degree is also conferred upon those who, as students of this institution, have completed the courses which represent one full year's work in any of the several curricula and have given satisfactory evidence of having previously completed the other courses of that curriculum. A candidate for the Bachelor's degree must announce his candidacy at the beginning of the school year at whose termination he expects to receive the degree. This announcement must be in writing and must specify both the curriculum and the degree sought.

The degree of Engineer of Mines, Metallurgical Engineer, Geological Engineer, or Civil Engineer, will be conferred upon a graduate of this school who has completed the corresponding undergraduate course; who has done at least two years of successful professional work along that line subsequent to receiving the Bachelor's degree, during one of which he has held a position of responsibility; and who has presented an original and acceptable thesis. The appropriate Engineer's degree will also be granted to a graduate of this school who has fulfilled the above scholastic and thesis requirements and who has had at least five years of professional experience along technical lines during one of which he has occupied a position of responsibility.

A candidate for the Engineer's degree should make application for the same on or before January first of the school year in which the degree is to be granted. He should at the same time submit the subject of his thesis which must be approved by the Faculty. Each thesis must be type written on paper eight and one-half by eleven inches, and must be submitted not later than March first. If it is found to be satisfactory the advanced degree will be granted on Commencement day at the end of the school year. A corrected copy of the thesis must be delivered to the President at least two weeks prior to the granting of the degree. It is expected that the thesis in each case shall be prepared with care and shall exhibit sufficient evidence of independent investigation to warrant its publication at the discretion of the Faculty. Work done at other colleges for a degree may be accepted so far as it corresponds to the work done here, but in each case the Faculty reserves the right to decide whether the previous work has been satisfactory.

All degrees are conferred by the Board of Regents upon the recommendation of the Faculty.

Curricula

MINING ENGINEERING.

METALLURGICAL ENGINEERING.

GEOLOGICAL ENGINEERING.

CIVIL ENGINEERING.

In the adjustment of the courses of the several curricula, it is assumed that one period of work in the class-room requires one

period of preparation, and therefore that one period of work in the class-room is equivalent to two periods of work in the field or in the laboratory. In the following outlined statement of curricula the number of periods per week required in the class-room and in the field or in the laboratory are given separately. The number of periods required in the field or in the laboratory represents *average* time, however, inasmuch as it is frequently advantageous, especially for field work, to concentrate into one week an amount of work equal to that which would require two or more weeks if performed in separate installments.

Short Courses

For the benefit of resident young men of the state short courses for a few weeks' duration will be given in prospecting, assaying, mineralogy, surveying, chemistry, mechanics, electricity, etc. Such a departure from the full college courses should appeal to those who wish to attain greater efficiency, which will mean a corresponding increase in wages.

UNIFORM CURRICULUM FOR THE FIRST TWO YEARS

The curriculum for the first and second years of the four courses offered at the School of Mines is the same in all respects. This arrangement is of advantage to the student, as it gives him until the beginning of the third year to determine for which of the four courses he is best fitted by inclination or aptitude.

Mathematics, physics, and chemistry are fundamental subjects for the successful engineer. For that reason the first two years of all the engineering courses are devoted to a thorough grounding in those three subjects as will be seen in the tabular statement below. Specialization does not begin until afterwards.

Excellent facilities are offered for the acquisition of a thorough knowledge of these subjects so necessary to successful engineering work both during the remainder of the course and during a professional career.

**UNIFORM CURRICULUM.
FRESHMAN YEAR.**

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
101	Algebra	4	
301	General Chemistry	4	6
103	Trigonometry	5	
411	Shop		4
401	Mechanical Drawing		6
805	Spanish	4	
801	English	3	
	Second Semester		
104	Analytic Geometry	5	
302	General Chemistry	4	
406	General Surveying	2	4
402	Mechanical Drawing		6
304	Qualitative Analysis	2	9
806	Spanish	4	
802	English	3	

UNIFORM CURRICULUM.
SOPHOMORE YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
105	Calculus	5	
201	Physics	4	3
305	Quantitative Analysis		6
509	Mineralogy	3	3
501	General Geology	3	
407	Mine Surveying and Mapping.....	1	4
807	Spanish	3	
803	English	1	
	Second Semester		
106	Calculus	4	
202	Physics	4	3
408	Topographic Surveying	2	4
510	Mineralogy	3	3
502	General Geology	3	
306	Quantitative Analysis		9
808	Spanish	3	
804	English	1	

MINING ENGINEERING

As one of the chief purposes of the School is to prepare men to become designers of mining plants and supervisors of mining operations, the strictly business careers of the profession are kept constantly before the student. Valuing property, properly reporting propositions submitted for investment, calculating the factors in the economical operation of a plant and suggesting the best methods of developing a property, are considerations which receive careful treatment and are given prominence during the latter part of the curriculum.

Especially are the similarities and departures between the operations and requirements of metal-mining and coal-mining brought out. Placer and hydraulic mining and dredging, and the recent adaptation of the steam shovel and stripping methods to western metal mines are treated at considerable length.

Another important feature which is continually being more and more considered in mining operations is the geology of mineral deposits, and this subject receives detailed consideration.

Freshman and Sophomore years. See pages 32 and 33.

JUNIOR YEAR

Course Number	Courses	Periods a week	
		Class	Lab'y
First Semester			
203	Direct and Alternating Currents.....	5	3
405	Descriptive Geometry	2	3
511	Petrology	2	3
307	Water and Fuel Analysis.....		3
701	Fire Assaying	1	
601	Principles of Mining.....	5	
703	Principles of Metallurgy.....	5	
403	Machine Drawing		3
Second Semester			
204	Mechanics	5	
512	Petrology	2	3
410	Railroad Surveying	2	4
504	Economic Geology	5	
704	Metallurgy of Iron and Steel.....	5	
702	Fire Assaying		3

SENIOR YEAR

Course Number	Courses	Periods a week	
		Class	Lab'y
First Semester			
607	Mine Administration and Accounts.....	2	
605	Mine Examination		4
507	Field Geology	1	3
705	Metallurgy of the Non-Ferrous Metals.....	5	
603	Ore Dressing	4	3
419	Masonry Construction	2	
423	Strength of Materials.....	2	
425	Hydraulics	3	
Second Semester			
420	Air Compression and Pumping.....	3	
708	Metallurgical Laboratory	1	3
604	Ore Dressing	3	
608	Design of Mine Plant.....		3
706	Metallurgy of the Non-Ferrous Metals.....	5	
422	Engines and Boilers.....	3	3
506	Ore Deposits	3	
404	Machine Design	1	3

METALLURGICAL ENGINEERING

The aim of this four years' course is to train the student for a professional career in any branch of metallurgical work. Attention is given during the first two years to such fundamental subjects as mathematics, chemistry, physics, geology, mineralogy, and preliminary courses in engineering. Instruction in metallurgy proper begins in the third year, both lectures and laboratory experiments being employed for the purpose. Chemistry and geology are provided for, also. The work of the fourth year is along the line of advanced courses in metallurgy; especial attention being given to laboratory experiments, high temperature conditions of metallurgy, training in execution and interpretation of results. Such higher branches of engineering, chemistry, and courses of importance in mining engineering claim a considerable share of attention.

The course has been chosen with special reference to giving the student in metallurgical engineering a general knowledge of modern metallurgy as a whole, and a special knowledge of the metallurgy of each of the more important metals.

Freshman and Sophomore years. See pages 32 and 33.

JUNIOR YEAR

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
203	Direct and Alternating Currents.....	5	3
405	Descriptive Geometry	2	3
511	Petrology	2	3
307	Water and Fuel Analysis.....		3
701	Fire Assaying	1	
601	Principles of Mining.....	5	
703	Principles of Metallurgy.....	5	
403	Machine Drawing		3
	Second Semester		
204	Mechanics	5	
512	Petrology	2	3
308	Electro-Analysis		3
504	Economic Geology	5	
704	Metallurgy of Iron and Steel.....	5	
702	Fire Assaying		8
206	Thermo-dynamics	2	

SENIOR YEAR

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
705	Metallurgy of the Non-Ferrous Metals.....	5	
603	Ore Dressing	4	3
423	Strength of Materials	2	
425	Hydraulics	3	
709	Metallurgical Calculations	1	
711	Metallurgical Plant Design.....	1	6
713	Metallography	2	3
607	Mine Administration and Accounts.....	2	
	Second Semester		
708	Metallurgical Laboratory	1	8
604	Ore Dressing	3	
706	Metallurgy of the Non-Ferrous Metals.....	5	
506	Ore Deposits	3	
712	Metallurgical Plant Design.....		6
714	Electro-Metallurgy	2	
310	Physical and Theoretical Chemistry.....	2	
420	Air Compression and Pumping.....	3	
404	Machine Design	1	3

GEOLOGICAL ENGINEERING

This course extending over a period of four years is intended primarily to train men to examine, report and direct the future development of mines. In the first two years a thorough training is given in fundamental subjects, especially in mathematics, chemistry, surveying, and other preliminary courses in engineering. In the second and third years the attention of the student is directed largely to geological subjects related closely to mining, namely: topographical surveying, geological surveying, petrology, and economic geology, while still continuing his studies in chemistry, mining, metallurgy, etc. The fourth year is devoted largely to advanced work in mining geology, visiting and reporting in detail on geological problems connected with ore deposition in various mining fields. Attention is also paid to the geological occurrence of petroleum.

Freshman and Sophomore years. See pages 32 and 33.

JUNIOR YEAR

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
203	Direct and Alternating Currents.....	5	3
405	Descriptive Geometry	2	3
515	Petrology	2	6
701	Fire Assaying	1	
601	Principles of Mining.....	5	
703	Principles of Metallurgy.....	5	
403	Machine Drawing		3
	Second Semester		
204	Mechanics	5	
516	Petrology	2	6
410	Railroad Surveying	2	4
504	Economic Geology	5	
704	Metallurgy of Iron and Steel.....	5	
702	Fire Assaying		8

SENIOR YEAR

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
607	Mine Administration and Accounts.....	2	
605	Mine Examination		4
507	Field Geology	1	8
705	Metallurgy of the Non-Ferrous Metals.....	5	
603	Ore Dressing	4	3
513	Paleontology	2	3
423	Strength of Materials.....	2	
425	Hydraulics	3	
	Second Semester		
604	Ore Dressing	3	
608	Design of Mine Plant.....		3
706	Metallurgy of the Non-Ferrous Metals.....	5	
514	Ore Deposits	5	
508	Applied Geology	2	8
310	Physical and Theoretical Chemistry.....	2	
404	Machine Design	1	3

CIVIL ENGINEERING

This department provides a course of study in the theory and application of the principles of civil engineering. The first two years of work are the same as in the other engineering courses, including practical work in drafting room and field, as well as instruction in the fundamental principles of mathematics and physics. In the third year the studies relate more directly to civil engineering. Technical courses cover the principles of structural and machine design, power and power transmission, and other fundamental engineering processes. In the drafting room the student applies those principles to the design of machines, and the bridge and roof trusses. Sufficient field work is given to make the student thoroughly familiar with surveying instruments, and their use in road, mine, and railroad surveys. The proper care and adjustment of surveying and engineering instruments are made prominent in the training of the civil engineer.

Freshman and Sophomore years. See pages 32 and 33.

JUNIOR YEAR

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
203	Direct and Alternating Currents.....	5	3
405	Descriptive Geometry	2	3
403	Machine Drawing		3
413	Roads and Pavements.....	2	3
415	Theory of Structure.....	3	3
701	Fire Assaying	1	
417	Materials of Construction.....	5	
	Second Semester		
204	Mechanics	5	
410	Railroad Surveying	2	4
704	Metallurgy of Iron and Steel.....	5	
702	Fire Assaying		3
504	Economic Geology	5	
206	Thermo-dynamics	2	

SENIOR YEAR

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
507	Field Geology	1	8
419	Masonry Construction	2	
421	Contracts and Specifications.....	2	
423	Strength of Materials.....	2	
425	Hydraulics	3	
427	Hydraulic Engineering		3
429	Cost Keeping and Management.....	1	
431	Reinforced Concrete	2	3
	Elective	5	
	Second Semester		
424	Bridge Design	2	3
430	Water Supply Engineering.....	3	3
428	Municipal and Sanitary Engineering.....	2	3
422	Engines and Boilers.....	3	3
420	Air Compression and Pumping	3	
426	Structural Design	3	3
	Elective	3	

CLASS SCHEDULE—FIRST SEMESTER

Period	Yr.	MON.	TUES.	WED.	THURS.	FRI.	SAT.
8:00 to 8:50	1	Span. 805	Span. 805	Span. 805	Span. 805		
	2	Math. 105	Math. 105	Math. 105	Math. 105	Math. 105	C. E. 4
	3	Met. 703	Met. 703	Met. 703	Met. 703	Met. 703	
	3	C. E. 417	C. E. 417	C. E. 417	C. E. 417	C. E. 417	
	4	Geol. 507	Met. 713	Geol. 513	Met. 713	Geol. 513	Geol. 5
8:50 to 9:40	1	Math. 101	Math. 101	Math. 101	Math. 101		
	2	Span. 807		Span. 807		Span. 807	C. E. 4
	3	Min. 601	Min. 601	Min. 601	Min. 601	Min. 601	
	4	C. E. 425	C. E. 423	C. E. 425	C. E. 423	C. E. 425	Geol. 5
9:40 to 10:30	1	Engl. 801		Engl. 801		Engl. 801	
	2	Phys. 201	Phys. 201	Phys. 201	Phys. 201	Engl. 803	C. E. 4
	3	C. E. 415	C. E. 413	C. E. 415	C. E. 413	C. E. 415	
	4	Met. 705	Met. 705	Met. 705	Met. 705	Met. 705	Geol. 5
10:30 to 11:20	1	Math. 103	Math. 103	Math. 103	Math. 103	Math. 103	
	2	Geol. 509		Geol. 509	C. E. 407	Geol. 509	C. E. 4
	3	Met. 701	Geol. 511	C. E. 405	Geol. 511	C. E. 405	
	4	Met. 709	Min. 603	Min. 603	Min. 603	Min. 603	Geol. 5
	4	C. E. 421	C. E. 421				
11:20 to 12:10	1	Chem. 301	Chem. 301	Chem. 301	Chem. 301		
	2	Geol. 501		Geol. 501		Geol. 501	C. E. 4
	3	Phys. 203	Phys. 203	Phys. 203	Phys. 203	Phys. 203	
	4	C. E. 419	Min. 607	C. E. 419	Min. 607	Met. 711	Geol. 5
	4		C. E. 431		C. E. 431	C. E. 429	
1:15 to 4:00	1	Chem. 301	C. E. 401	Chem. 301	C. E. 401	C. E. 411	
	2	Chem. 305	Phys. 201	Chem. 305	Geol. 509		C. E.
	3	Geol. 511	C. E. 403	C. E. 405	Phys. 203	Chem. 307	
	3	C. E. 413		Geol. 515		C. E. 415	
	4	Min. 603	Min. 605	Met. 713	C. E. 431	Geol. 513	Geol.
	4	C. E. 427	Met. 711		Met. 711		

CLASS SCHEDULE—SECOND SEMETER

Period	Yr.	MON.	TUES.	WED.	THURS.	FRI.	SAT.
8:00 to 8:50	1	Span. 806	Span. 806	Span. 806	Span. 806		C. E. 406
	2	Math. 106	Math. 106	Math. 106	Math. 106		C. E. 408
	3	Met. 704	Met. 704	Met. 704	Met. 704	Met. 704	Met. 702
	4	Geol. 506	Geol. 514	Geol. 506	Geol. 514	Geol. 506	Met. 708
	4	C. E. 430	C. E. 424	C. E. 430	C. E. 424	C. E. 430	Geol. 508
8:50 to 9:40	1	Math. 104	Math. 104	Math. 104	Math. 104	Math. 104	C. E. 406
	2	Span. 808	C. E. 408	Span. 808	C. E. 408	Span. 808	C. E. 408
	3		Geol. 512	C. E. 410	Geol. 512	C. E. 410	Met. 702
	4	C. E. 404	Min. 604	Min. 604	Min. 604	Met. 708	Met. 708
	4						Geol. 508
9:40 to 10:30	1	Engl. 802	C. E. 406	Engl. 802	C. E. 406	Engl. 802	C. E. 406
	2	Phys. 202	Phys. 202	Phys. 202	Phys. 202	Engl. 804	C. E. 408
	3	Geol. 504	Geol. 504	Geol. 504	Geol. 504	Geol. 504	Met. 702
	4	Met. 706	Met. 706	Met. 706	Met. 706	Met. 706	Met. 708
	4	C. E. 426		C. E. 426		C. E. 426	Geol. 508
10:30 to 11:20	1			Chem. 304		Chem. 304	C. E. 406
	2	Geol. 510		Geol. 510		Geol. 510	C. E. 408
	3	Phys. 204	Phys. 204	Phys. 204	Phys. 204	Phys. 204	Met. 702
	4	C. E. 420	Chem. 310	C. E. 420	Chem. 310	C. E. 420	Met. 708
	4						Geol. 508
11:20 to 12:10	1	Chem. 302	Chem. 302	Chem. 302	Chem. 302		C. E. 406
	2	Geol. 502		Geol. 502		Geol. 502	C. E. 408
	3			Phys. 206		Phys. 206	Met. 702
	4	C. E. 422	C. E. 428	C. E. 422	C. E. 428	C. E. 422	Met. 708
	4		Geol. 508		Geol. 508		Geol. 508
1:15 to 4:00	4		Met. 714		Met. 714		
	1	Chem. 304	C. E. 402	Chem. 304	C. E. 402	Chem. 304	C. E. 406
	2	Chem. 306	Phys. 202	Chem. 306	Geol. 510	Chem. 306	C. E. 408
	3	Geol. 512	C. E. 410	Geol. 516		Chem. 308	Met. 702
	4	Min. 608		C. E. 422	C. E. 428	C. E. 426	Met. 708
	4	C. E. 424	C. E. 430		C. E. 404		Geol. 508
	4	Met. 712	Met. 712				

DEPARTMENTS OF INSTRUCTION

DEPARTMENT OF MATHEMATICS

PROFESSOR REECE.

Great importance is attached to the study of mathematics as a necessary basis for further instruction in the various engineering courses.

All students, taking a regular course, are required to study mathematics during their freshman and sophomore years.

A description of the several mathematical courses follows:

101. Algebra

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, four periods a week.

Graphical representation; variables and functions; theory of exponents; logarithms; the equation; inequalities; ratio, proportion and variation; mathematical induction; binominal theorem; progressions; complex numbers; undetermined coefficients; partial fractions.

103. Trigonometry

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, five periods a week.

The trigonometric functions are defined as ratios; proofs of the principal formulas used in the solution of both the plane and spherical triangles; trigonometric transformations; circular measure of angles; solution of trigonometric equations; inverse trigonometric functions; solution of right and oblique triangles, plane and spherical, with and without the use of logarithms.

104. Analytic Geometry

Prerequisites: Courses 101 and 103.

Time: Freshman year, second semester.

Lectures, five periods a week.

Systems of coordinates; graphical representation of a function; transformation of coordinates; the straight line; parabola;

circle; ellipse; hyperbola; transcendental functions; empirical equations; space coordinates; space curves; surfaces.

105. Calculus

Prerequisites: Course 104.

Time: Sophomore year, first semester.

Lectures, five periods a week.

Derivatives; geometrical and physical interpretation of a derivative; successive differentiation; application of derivatives to physics, curves, maxima and minima; differentiation of transcendental functions; mean values; differentials; integration as the inverse of differentiation; some simple applications of integration.

106. Calculus

Prerequisites: Course 105.

Time: Sophomore year, second semester.

Lectures, four periods a week.

This is a continuation of Course 105 and treats of curvature; asymptotes; partial derivatives; formal integration; use of integral tables; integration as a summation process; successive integration; series; application of definite integrals, including double and triple integrals, to geometry and mechanics.

In addition to the above subjects which are required in all courses, opportunity for further work in mathematics is given. The department will also endeavor to meet the needs of graduate students desiring to engage in mathematical investigations of problems of engineering.

107. Applied Mathematics

Prerequisites: The calculus.

Time: To be arranged.

A course for practical instruction in numerical and mechanical calculations as required in engineering sciences. Numerical solution of algebraic, transcendental and differential equations; the construction of graphical charts; curve fitting to empirical data; approximate methods of differentiation and integration.

108. Advanced Calculus

Prerequisites: Elementary calculus.

Time: To be arranged.

A course treating of functions represented by series with applications to approximations in calculations; differential equations of the first order; linear differential equations; total and partial differential equations with applications to engineering problems.

DEPARTMENT OF PHYSICS

PROFESSOR REECE.

The following is a detailed description of the several courses in the Department of Physics.

201. Physics

Prerequisites: Courses 101, 103, 104.

Time: Sophomore year, first semester.

Lectures, four periods a week.

Laboratory, three periods a week.

The lectures cover the fundamental principles of mechanics of solids; liquids and gases; heat; introduction to thermodynamics; wave motion.

The laboratory course follows and supplements the lectures. It is quantitative in character and involves the careful determination and measurement of the principal quantities in physics. The course has for its objects the fixing in mind of the essential principles of physics, the furnishing of direct proof of some of the fundamental laws; and of giving the student acquaintance with the methods and instruments of physical and technical operations; and of developing skill in the making and reducing measurements of precision.

The laboratory work consists of the following experiments: Equilibrium of forces; composition and resolution of forces; accelerated motion; relation of force to mass and acceleration; moments; impact; Young's modulus; coefficient of rigidity; moment of inertia; simple harmonic motion; measurement of gravitation constant; coefficient of expansion; calorimetry; Boyle's law; Archimedes' principle; and others if time permits.

202. Physics

Prerequisites: Courses 105 and 201.

Time: Sophomore year, second semester.

Lectures, four periods a week.

Laboratory, three periods a week.

This course is a continuation of Course 201 and includes the study of sound, light, and electricity and magnetism. Particular

stress is laid upon reflection and interference of waves; upon electrical resistance, potential and impedance.

Parallel with the lecture course is the laboratory course. The experiments include; determination of pitch and composition of sounds; length of sound waves; velocity of sound; diffraction and interference of light; photometry; refraction; spectrum analysis; measurements of current; resistance; electromotive forces; capacities; inductances.

203. Direct and Alternating Currents

Prerequisites: Courses 106 and 202.

Time: Junior year, first semester.

Lectures, five periods a week.

Laboratory, three periods a week.

Discussions and laboratory work on electric circuits and resistance, magnetic circuits, electro-magnets, Ohm's law, measurement of resistance and power in electric circuits, direct current generators and motors; starters and controllers; storage batteries, the practical operation of generators and motors; inductance, capacity, reactance, impedance, power factor, alternators, induction motors, transformers, electric illumination, practical operation of machines.

204. Mechanics

Prerequisites: Courses 106 and 201.

Time: Junior year, second semester.

Lectures, five periods a week.

This course treats of concurrent and parallel forces; center of gravity; couples; non-concurrent forces; moment of inertia; flexible cords; rectilinear, curvilinear and rotary motion; work; energy; friction; impact, etc.

206. Thermodynamics

Prerequisites: Courses 106 and 201.

Time: Junior year, second semester.

Lectures, two periods a week.

Topics treated: mechanical theory of heat; work done and heat expended in expansion; cycles of perfect gases and vapors; heat engines; commercial results obtained and possibilities of development of steam, air, and gas engines; refrigerating machines; flow of steam; injectors; condensers.

DEPARTMENT OF CHEMISTRY

PROFESSOR ILLINSKI.

The equipment of the chemical laboratory (elsewhere described) is such as to make it possible to offer a number of courses essential to chemical engineering, in addition to those required by the curricula already outlined. These courses are designated SPECIAL and will be given upon the request of a sufficient number of students.

301. General Chemistry

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, four periods a week.

Laboratory, six periods a week.

This course is introductory to the engineering courses and is required of all students. The fundamental principles of the science are taught in connection with the descriptive chemistry of the more important non-metals. The lectures are designed to precede the work of the laboratory, in which the student is expected to illustrate and verify the facts and principles which have been discussed in the lectures. Careful manipulation, thoroughness in observation, accuracy in arriving at conclusions, and neatness in note-taking are required of each student.

No previous study of chemistry is required for admission to this course, but the laboratory instruction is so arranged that students who have already spent considerable time upon chemical work in the secondary school are permitted to conduct experiments of a somewhat advanced character, in which the knowledge they have already acquired is utilized.

302. General Chemistry

Prerequisite: Course 301.

Time: Freshman year, second semester.

Lectures, four periods a week.

Continuation of course 301. Devoted to the chemistry of the

metals, with particular attention being paid to the reactions employed in analytical chemistry, in metallurgy, and in geology. The knowledge of the laws and theories previously acquired is applied to practical examples as they arise.

304. Qualitative Analysis

Prerequisites: Course 301, accompanied by course 302.

Time: Freshman year, second semester.

Lectures, two periods a week.

Laboratory, nine periods a week.

The lectures include a thorough grounding in the principles upon which are based the qualitative separations and the identification of the commoner elements. In the laboratory the student is given practical instruction in manipulation that he may best apply the knowledge gained in the lectures. He is gradually led through the more simple separations to the analysis of alloys, minerals, rocks, slags, and mattes. A neat, systematic notebook containing the method of separation used, the reasoning involved in its selection, the confirmatory tests, and all the equations involved, is an essential part of this course.

305. Quantitative Analysis

Prerequisite: Course 304.

Time: Sophomore year, first semester.

Laboratory, six periods a week.

A course embodying the general principles of quantitative analysis and introductory to those involving special quantitative methods. In the laboratory the following experiments are performed: The gravimetric determination of chlorine in a soluble chloride; water of crystallization in copper sulphate; iron and sulphur in ferrous sulphate; carbon dioxide; calcium and magnesium in dolomite; alumina in an alum; closing with a complete analysis (technical) of a clay.

306. Quantitative Analysis

Prerequisite: Course 305.

Time: Sophomore year, second semester.

Laboratory, nine periods a week.

A thoroughly practical course, largely volumetric, in the determination of the important constituents of ores and metallur-

gical products. The methods taught are those in use in the large smelters of the West. The student works upon checked samples of widely varying composition until he becomes familiar with the various methods and can carry them out under all conditions with accuracy and rapidity.

Each student is required to analyze two or more ores for each of the following: Iron, copper, zinc, lead, phosphorus, calcium, manganese, sulphur and arsenic. The essential parts of the course are speed tests, in which the students are required to report correct results on a number of copper, zinc and lead ores.

307. Water and Fuel Analysis.

Prerequisite: Course 306.

Time: Junior year, first semester.

Laboratory, three periods a week.

This course is designed to meet the wants of engineering students. Analyses of water are made in regard to their possible use in boilers. These analyses involve the determination of total solids, organic and volatile matter, silica, iron and alumina, calcium, magnesium, sodium, potassium, and carbonic, sulphuric and hydrochloric acids.

Analysis of various coals and other fuels are made, their heat values calculated from these analyses and also determined by means of a calorimeter. Flue gases are analyzed and the results interpreted. The flash-point, burning point, specific gravity, viscosity and acidity of oils are determined.

308. Electro-Analysis

Prerequisite: Course 306.

Time: Junior year, second semester.

Laboratory, three periods a week.

This course will deal with the practical application of the electric current in determining some of the common metals such as copper, silver, lead and zinc. After the student has become familiar with the methods used for determining each of these, he will use the current in separating mixtures of metals and as a rapid, accurate method of ore analysis.

310. Physical and Theoretical Chemistry

Prerequisite: Course 302.

Time: Senior year, second semester.

Lectures, two periods a week.

The elements of theoretical chemistry have already been studied in the course in general chemistry, qualitative and quantitative analysis. The subject is here pursued more exhaustively. The principal subjects considered are: The gas laws, atomic and molecular weights and the methods of determining them, forms and the phase rule, kinetic theory, thermo-chemistry, ionization, dissociation and balanced actions and electro-chemistry.

311. Advanced Quantitative Analysis. (Special)

Prerequisite: Course 306.

Time: Junior year.

Laboratory, six periods a week.

This course is the extension of Course 4, and the work will be chosen to suit the need of each student. It may consist of the analysis of rocks and minerals, speisses, crude and refined lead and copper bullion, spelter, iron and steel, cement, or the determination of some of the rare elements.

312. Inorganic Preparations. (Special)

Prerequisite: Course 306.

Time: Junior year.

Laboratory, six periods a week.

Chemically pure substances of commercial importance are prepared by the student with constant attention to the securing of maximum yield. Skill in manipulation is encouraged, methods of manipulation not occurring in other courses are practiced, and a general increased knowledge of inorganic chemistry is acquired.

313. Industrial Inorganic Chemistry. (Special)

Prerequisite: Course 302.

Time: Junior year.

Lectures, two periods a week.

The utilization of inorganic materials in manufacturing processes was taken up in an elementary way in connection with general chemistry. This special industrial course goes into the

subject considerably more in detail. The manufacturing processes considered are mainly those of acids, alkalies, mineral dyes, mineral paints, explosives and matches.

The aim is to expound the dominant principles underlying each process rather than to present such an account of the details as will suffice for the student of any particular industry. In this manner, the student is prepared to study efficiently the literature of any branch in which he may afterwards become especially interested.

314. Organic Chemistry. (Special)

Prerequisite: Course 302.

Time: Junior year.

Lectures, two periods a week.

Laboratory, six periods a week.

This course serves as an introduction to the study of the hydrocarbons of both the fatty and aromatic series, alcohols, phenols, aldehydes, organic acids, ethers, esters and carbohydrates. Their formation, relations and derivatives are discussed, and special attention is given to the explanation of familiar organic phenomena.

DEPARTMENT OF CIVIL ENGINEERING

The courses in engineering described in the pages immediately following are designed to train the student in the theory and practice of those subjects which form the basis of professional practice. He is taught the construction, care and use of engineering instruments and the methods used in the solution of the usual problems of practice. The advanced courses give special attention to materials for roads, highways, buildings and general engineering construction, and the methods used in conventional design of engineering structures.

Opportunities are numerous for the study of irrigation and drainage engineering as the Rio Grande Project of the United States Reclamation Service of which the Elephant Butte dam is a part, is within ninety miles of Socorro.

401. Mechanical Drawing

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Laboratory, six periods a week.

This course involves the use of instruments, geometric construction, representation of objects by orthographic and isometric projections. Special attention is given to lettering, shading and the principles of dimensioning.

Reference: French, *Engineering Drawing*.

402. Mechanical Drawing

Prerequisites: Course 401.

Time: Freshman year, second semester.

Laboratory, six periods a week.

A continuation of Course 401: Intersections and developments of planes and solids, isometric and perspective drawings. Shop drawings of machine parts from sketches and models.

Reference: French, *Engineering Drawing*.

403. Machine Drawing

Prerequisites: Courses 401 and 402.

Time: Junior year, first semester.

Laboratory, three periods a week.

Here the student makes working drawings from machine parts; first while having this part directly before him, and later from a freehand sketch of the part, without having the latter to look at while drawing. He thereby becomes familiar not only with methods of dimensions, laying out and reading working drawings but also those of making and using sketches. Throughout the entire course particular stress is laid on neat lettering, correct dimensioning and symmetrical arrangement of drawings.

404. Machine Design

Prerequisites: Courses 401, 402, 403, 105.

Time: Senior year, second semester.

Lectures, one period a week.

Laboratory, three periods a week.

A study of the design of machine elements and modern machines and of the nature, strength and action under stress of the materials used in machine construction. Recitations are carried on including the discussion of problems suitable for illustration of important points. In the drafting room each student completes the design of some especially assigned machine.

405. Descriptive Geometry

Prerequisites: Courses 402 and 103.

Time: Junior year, first semester.

Lectures, two periods a week.

Laboratory, three periods a week.

The representation of all geometrical magnitudes is made possible by means of orthographic projections. The student is required to solve various problems involving points, lines, surfaces and solids and demonstrate same at blackboard.

406. General Surveying

Prerequisites: Courses 101 and 103.

Time: Freshman year, second semester.

Lectures, two periods a week.

Field Work, four periods a week.

An introductory course in surveying, including the use, care, and adjustment of instruments; linear and angular measurements with the transit, level, compass and minor instruments. Students are given practice in traversing, computing areas, triangulating, topographic mapping and the keeping of accurate notes.

Reference: Breed and Hosmer, *Surveying*, Vol. 1.

407. Mine Surveying and Mapping

Prerequisites: Course 406.

Time: Sophomore year, first semester.

Lectures, one period a week.

Field Work and Mapping, four periods a week.

The course involves lectures and recitations on the theory of Mine Surveying as applied both to surface claims and underground workings. Actual survey of the Merrit Mine and a complete map of the underground workings is required of each student.

Reference: Durham, *Mine Surveying*.

408. Topographic Surveying

Prerequisites: Course 406.

Time: Sophomore year, second semester.

Lectures, two periods a week.

Field Work, four periods a week.

This course deals with use of transit and plane table in topographic surveying. Stadia and other methods used in locating topographical features. Use of triangulation and base lines also considered. A complete survey will be made and plotted.

Reference: Breed and Hosmer, *Surveying*, Vol. 2.

410. Railroad Surveying

Prerequisites: Courses 406, 408.

Time: Junior year, second semester.

Lectures, two periods a week.

Field Work and Drawing, four periods a week.

The course includes the study of the economic theory of railway location, computation of railway curves, transitions, turn-

outs, and earth works. The field work involves preliminary and location surveys, computing, making notes for and locating simple and compound curves.

411. Wood Shop

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Laboratory, four periods a week.

The student is taught the use and care of wood working tools. Exercises in simple joints, and whenever possible, the student is allowed to make useful articles, working from blue prints and working sketches.

413. Roads and Pavements

Prerequisites: Courses 406 and 410.

Time: Junior year, first semester.

Lectures, two periods a week.

Laboratory, three periods a week.

A study of the various methods of construction of the different types of roads and pavements, road materials, care of road surfaces, the proper use of paving materials and the economics of road building.

The laboratory work consists of cement testing, and road and pavement design.

415. Theory of Structures

Prerequisites: Courses 103 and 202.

Time: Junior year, first semester.

Lectures, three periods a week.

Laboratory, three periods a week.

The study of graphic statics and analytical methods as applied to roof and bridge trusses, involving loads, reactions, shears, moments, shear and moment diagrams and graphical analysis of trusses.

417. Materials of Construction

Prerequisites: Courses 103, 202, 413 accompanying.

Time: Junior year, first semester.

Lectures, five periods a week.

The study of the principles of mechanics underlying the laws

of the strength of materials; involving elastic and inelastic materials, their action under stresses of all kinds, results of tests of materials, curves of strength, a study of the strength of steel of varying composition and the fatigue of metals.

Reference: Johnson, *Materials of Construction*.

419. Masonry Construction

Prerequisites: Courses 204, 423 accompanying.

Time: Senior year, first semester.

Lectures, two periods a week.

In this course the attention of the student is directed chiefly toward the use of cement as a building material; concrete and other forms of masonry are studied in foundations, piles, retaining walls, dams, buildings and bridges, practical problems in computation and design are included.

420. Air Compression and Pumping

Prerequisite: Course 427.

Time: Senior year, second semester.

Lectures, three periods a week.

Part I. Discussion of pumping, pump problems, and pump details. Types of pumps: Force pumps, crank and flywheel, direct acting, duplex, compound and triple expansion pumps.

Part II. A study of the action of air during compression and expansion; its flow through pipes; and, also, the various types of air compressing and actuating machinery.

References: Barr, *Pumping Machinery*.

Peele, *Compressed Air*.

421. Contracts and Specifications

Prerequisites: Courses 802 and 804.

Time: Senior year, first semester.

Lectures, two periods a week.

Laws of contracts covering contracts, agency, torts, and independent contractor; contracts of sale, association, transportation, etc. Study of engineering contracts and specifications with problems in contract and specification writing.

Reference: Tucker, *Contracts in Engineering*.

422. Engines and Boilers

Prerequisites: Course 202.

Time: Senior year, second semester.

Lectures, three periods a week.

Laboratory, three periods a week.

Part I. A general descriptive course on engines, their types, details, construction and management is given. The student is taught the use of the indicator, to take cards from an engine and correct the different valve events.

Part II. This course is devoted to the study of steam boilers. The lectures include the history, theory and design of modern steam boilers. Each student works out a complete design of a boiler.

423. Strength of Materials

Prerequisite: Course 204.

Time: Senior year, first semester.

Lectures, two periods a week.

This course is a study of the stresses and deformation of bodies subjected to tension, to compression, to shearing, to torsion; the study of elasticity of bodies; stresses in and design of pipes, riveted joints and hooks. Treats of the theory of beams with discussion of bending moments, shearing forces and distribution of stress.

424. Bridge Design

Prerequisites: Courses 204, 423, 415.

Time: Senior year, second semester.

Lectures, two periods a week.

Laboratory, three periods a week.

A study of the different types of simple span bridges, trusses, cantilevers, plate girders, etc., and of the design of a bridge of a selected type.

425. Hydraulics

Prerequisite: Course 204.

Time: Senior year, first semester.

Lectures, three periods a week.

Study of fluid pressure, and laws governing the flow of water

through orifices and pipes, over weirs, in closed conduits, and in open channels. The hydraulic laws relating to water wheels, etc., are briefly discussed.

426. Structural Design.

Prerequisites: Courses 415 and 423.

Time: Senior year, second semester.

Lectures, three periods a week.

Laboratory, three periods a week.

A course in which each student is given a different set of data and is required to make computations, designs and working drawings of several structures, such as a roof truss, plate girder and a riveted or pin connected bridge.

427. Hydraulic Engineering

Prerequisites: Courses 204, 425 accompanying.

Time: Senior year, first semester.

Laboratory, three periods a week.

A course for civil engineers in river hydraulics for power or irrigation including the study of drainage areas, steam flow, discharge and rating curves, storage reservoirs for power or irrigation and the economics of water supply engineering.

428. Municipal and Sanitary Engineering

Prerequisites: Course 425.

Time: Senior year, second semester.

Lectures, two periods a week.

Laboratory, three periods a week.

A study of quantity of house-sewage and storm water, and the shape and dimensions of pipes and conduits for carrying the same. The use of flush tanks, man-holes and the ventilating systems.

429. Cost Keeping and Management

Prerequisites: Course 421 accompanying.

Time: Senior year, first semester.

Lectures, one period a week.

An elementary course on principles which govern the organization and management of labor on construction; systems of measurement, payment and efficient methods of cost keeping.

430. Water Supply Engineering

Prerequisites: Course 425.

Time: Senior year, second semester.

Lectures, three periods a week.

Laboratory, three periods a week.

The design, construction and maintenance of municipal water supply systems, under the following divisions: Sources and requisites of water supply; methods of collecting, storage and distributing, etc.

Reference: Turneaure and Maurer, *Public Water Supply*.

431. Reinforced Concrete

Prerequisites: Courses, 415, 423.

Time: Senior year, first semester.

Lectures, two periods a week.

Laboratory, three periods a week.

This course is a study of the design of beams, girders, columns, etc. A design of a concrete building including forms is required of each student.

DEPARTMENT OF GEOLOGICAL ENGINEERING

PROFESSOR WELLS.

This department aims to develop a thorough understanding of ore occurrences and their relations to geological structure. It deals with that fundamental knowledge of minerals and conditions of ore deposition upon which the success of the operator so largely depends. It endeavors to give a training so that exploration and exploitation may be carried on, not only with accumulated knowledge, but also with more of the precision and certainty of scientific methods. In brief, its general aim is to promote an intelligent, systematic study of conditions, so that mining may become more and more a business and that the element of chance may be reduced to a minimum.

501. General Geology

Prerequisites: Entrance requirements.

Time: Sophomore year, first semester.

Lectures, three periods a week.

Occasional field trips.

This course is designed to give a thorough foundation on which to base the more advanced geological courses that follow. It consists of lectures, recitations, laboratory work with the common minerals and rocks, the study and interpretation of topographic maps, and occasional excursions into the field.

Dynamic and structural geology are the two branches of the subject receiving the greatest emphasis. The laws and methods of interpretation are discussed with considerable detail, training in the deciphering of geological phenomena being the object sought.

The area surrounding Socorro is especially rich in varied and striking geological types. The old Socorro volcano, rising 2,500 feet above the campus presents many typical rocks and many structures associated with volcanic districts. Folding, faulting, and jointing are well displayed. A few miles to the east excellent

series of the various sedimentaries are illustrated. The local geological occurrences are utilized wherever practicable to illustrate the subject matter of the course.

References and Texts:

Chamberlin and Salisbury, *College Geology*.
Pirsson and Schuchert, *A Text-book of Geology*.
Publications of the U. S. G. S.
Lecture Notes.

502. General Geology

Prerequisite: Course 501.

Time: Sophomore year, second semester.

Lectures, three periods a week.

Historical geology comprises the major portion of the course. The various eras, periods, and epochs of the earth's history from cosmic to present time are studied in chronological order. The distribution and classification of the sedimentary rocks are taken up and the methods of correlation explained. In the study of the life of the earth during earlier geological eras as recorded by the fossils, special attention is paid to the development of characteristic and predominant forms. Sufficient time is devoted to the study of fossils to enable the student to determine the age of fossiliferous beds. Throughout the course those phases of historical geology are emphasized, the understanding of which is essential to the intelligent perusal of geological literature.

References and Texts: The same as for Course 501.

504. Economic Geology

Prerequisites: Courses 501, 502, 509, and 510.

Time: Junior year, second semester.

Lectures, five periods a week.

This course takes up the origin, nature, and occurrence of the economically valuable mineral deposits, both metallic and non-metallic; the various deposits being classified according to their origin rather than their chemical composition. Type forms, especially those developed in the United States, are emphasized. Among the non-metallic deposits studied are coal, oil, gas, cements, gypsum, salt, sulphur, clay, building stones, abrasives, gems, soils, and fertilizers. The study of the metallic ore deposits

includes those of iron, copper, lead, zinc, silver, gold, platinum and minor metals. Many of the New Mexico deposits are considered.

References and Texts:

Lindgren, *Mineral Deposits*.

Ries, *Economic Geology of the United States*.

Beck, *The Nature of Ore Deposits*.

U. S. G. S. Publications.

506. Ore Deposits

Prerequisite: Course 504.

Time: Senior year, second semester.

Lectures, three periods a week.

Deposits of the metallic ores are here treated more intensively than is possible in the time allotted to Course 504. The principles of secondary enrichment receive detailed treatment; also their application to the various types of ore deposits. The chemistry and mineralogy of secondary enrichment are gone into quite deeply with the purpose of giving the student sufficient knowledge along these lines to determine whether a given ore deposit is of primary or secondary origin and whether or not it is liable to continue to considerable depths. The important ore deposits of the United States which are characterized by secondary enrichment are carefully studied in that connection. This course constitutes one of the most valuable branches of mining geology.

References and Texts:

Posepny and others, *The Genesis of Ore Deposits*.

Emmons, *The Enrichment of Ore Deposits*.

U. S. G. S. Publications.

507. Field Geology

Prerequisites: Courses 501, 502, 504, 509, 510, 511, 512, 408.

Time: Senior year, first semester.

Lectures, one period a week.

Field work, eight periods a week.

While actual field practice comprises the larger part of the work, a considerable portion of the time is devoted to the writing of reports, office work in the construction of geological maps

and sections, and the study of similar maps of the United States Geological Survey. The field work consists both of the rapid mapping of geological formations in large areas and the accurate location and mapping of formation boundaries, faults, vein outcrops, etc., in restricted areas. Practice is given in the use of the plane table and alidade when the party consists of several members, and of the small plane table and the geologists compass as utilized for geological mapping when no assistant is available. Geological boundaries are also located on topographical maps with the aid of the contours alone. The report required at the end of the course includes the probable geological history, classification of formations, and dominant geological processes illustrated in the area studied, as well as appropriate geological maps.

508. Applied Geology

Prerequisite: Course 507.

Time: Senior year, second semester.

Lectures, two periods a week.

Field work, eight periods a week.

This course is designed primarily for students specializing in geological engineering. The field work is confined as far as practicable to neighboring mining districts and includes the study of the various surface structures, vein outcrops, underground and surface geological mapping, and the solution of problems dealing with the methods of ore deposition and occurrence. The petrographic and chemical examination of the rocks and ores under consideration constitutes a portion of the course. The work given may be varied in part according to the preference of the student.

509. Mineralogy

Prerequisites: Courses 301, 302, and 304.

Time: Sophomore year, first semester.

Lectures, three periods a week.

Laboratory, three periods a week.

Crystallography occupies a portion of the first ten weeks of the course. Only those phases are emphasized which are of practical value in the determination and proper understanding of

minerals, the drill in this portion of the subject being quite thorough. In the laboratory work each student is required to become familiar with the various crystal forms as illustrated by the large number of crystal models and well developed crystal minerals in the school collection. Proficiency is required in the determination of interfacial angles by means of the contact goniometer and the determination of the crystal form of microscopic crystals by examination with the hand lens.

Practice in the determination of the elements found in minerals accompanies the instruction in crystallography. Blowpipe identifications are emphasized as far as is consistent with dependable results. For those elements which do not give distinctive reactions in blowpipe analysis, the most satisfactory wet methods of determination are used.

After the completion of the above work the minerals are taken up in systematic order. Over two hundred of the more common minerals are considered in this and the following course, stress being placed on their recognition by means of crystal form, cleavage, hardness, specific gravity, luster and other physical properties. The order of study followed in the lectures is: The elements, sulphides, sulpho-salts, haloids, oxides, aluminates, ferrites, hydroxides, carbonates, phosphates, nitrates, borates, sulphates, tungstates, molybdates, and silicates. The relative values of the minerals both from the standpoint of economic use and mineralogical significance are clearly and fully set forth.

References and Texts:

Rogers, *Study of Minerals*.

Dana, *A System of Mineralogy*.

Brush and Penfield, *Determinative Mineralogy*.

Lecture Notes.

510. Mineralogy

Prerequisite: Course 509.

Time: Sophomore year, second semester.

Lectures, three periods a week.

Laboratory, three periods a week.

The study of the individual minerals begun in Course 509 is here continued. The latter portion of the semester's work is

spent in the determination of the unknown minerals both in the usual form of occurrence and in a powdered condition. Those minerals which cannot be determined by physical characteristics are tested by appropriate blowpipe and wet methods. The ability to identify the common minerals alone and in combination as they are likely to be found in field practice is the aim kept in view. The reference and the text books are the same as in Course 509.

511. Petrology

Prerequisites: Courses 501, 502, 509, and 510.

Time: Junior year, first semester.

Lectures, two periods a week.

Laboratory, three periods a week.

The effective study of rocks in their different aspects is the purpose of this and the following course which are here described together. The igneous, sedimentary and metamorphic divisions are taken up in considerable detail, both from a megascopic and microscopic standpoint.

The classification of rocks according to Kemp, together with the theory and manipulation of the petrographic microscope and the study of oriented sections of a large number of individual minerals, occupy the first eight weeks of the course. Upon the completion of this work, the various rock species are considered, the attention paid to any particular type being determined by its frequency of occurrence and importance in general geological practice. Thin sections of the various rock specimens in the collection are used as far as possible so that the student may have the benefit of comparing and confirming megascopic determinations with the more accurate results of microscopic examination.

The microscope is also used to unravel the relations of the individual minerals in fine grained rocks, their order of crystallization, and other characteristics that are not apparent in the examination with the hand lens alone. In this connection the sedimentary and metamorphic rocks, as well as the igneous varieties, are utilized.

Along with the above work general metamorphic processes, both constructive and destructive, are given considerable atten-

tion, especially as they effect the development of the various rocks.

References and Texts:

Luquer, *Minerals in Rock Sections*.

Kemp, *Handbook of Rocks*.

Winchell, *Elements of Optical Mineralogy*.

Johannsen, *Determination of Rock-forming Minerals*.

Leith and Mead, *Metamorphic Geology*.

512. Petrology

Prerequisite: Course 511.

Time: Junior year, second semester.

Lectures, two periods a week.

Laboratory, three periods a week.

The work given under Course 511 and 512 is conducted throughout the years as described under the former course. There is no noteworthy change at the beginning of the second semester either as to subject matter or text books.

513. Paleontology

Prerequisites: Courses 501 and 502.

Time: Senior year, first semester.

Lectures, two periods a week.

Laboratory, three periods a week.

This course is intended primarily for those specializing in geological engineering and is a much more thorough course than can be given in the brief time allotted to Paleontology in Course 502. It includes the study of the invertebrate index fossils characteristic of the geological horizons of North America.

References and Texts:

Zittel, *A Text-book of Paleontology*.

Grabau and Shimer, *North American Index Fossils*.

514. Ore Deposits

Prerequisite: Course 504.

Time: Senior year, second semester.

Lectures, five periods a week.

The material here offered is the same as that given under Course 506 with some additional instruction along similar lines

for the benefit of geological engineers. Three of the five periods are the same as in Course 506. The other two periods are given as arranged for at the convenience of the instructor and the students taking the course.

515. Petrology

Prerequisites: Courses, 501, 502, 509, and 510.

Time: Junior year, first semester.

Lectures, two periods a week.

Laboratory, six periods a week.

This course is offered for those following the geological engineering curriculum. It is an amplification of Course 511, the work given in the lectures and for three periods a week in the laboratory being the same as in the briefer course, and at the same hours. The additional laboratory work is utilized for more searching examination of slides and hand specimens and for the consideration of a greater variety of rocks.

516. Petrology

Prerequisite: Course 515.

Time: Junior year, second semester.

Lectures, two periods a week.

Laboratory, six periods a week.

This course is a continuation of Course 515. With the exception of three laboratory periods of each week which are conducted by special arrangement as to time, the work is the same as given in Course 512.

517. Ore Genesis

Prerequisite: Course 504.

Time: Senior year, either semester.

Lectures, two periods a week.

Laboratory, three periods a week.

The study of the paragenesis and origin of the minerals of a certain ore deposit. The student makes a collection of the deposit which is then studied in the laboratory by means of microscopic slides and polished surfaces, microchemical tests, etc. This is a special course to be given at the request of a sufficient number of students.

518. Special Problems

Prerequisites: Courses 504, 506, and 507.

Time: Senior year, second semester.

Laboratory, five periods a week.

Research work in some branch of the science of geology, such as investigation in petrology, stratigraphy, paleontology, or ore deposits. This work may form the basis of a thesis in Geological Engineering.

DEPARTMENT OF MINING ENGINEERING

PROFESSOR SNYDER.

The instruction in mining is given by means of lectures illustrated by photographs and detailed drawings. Recitations are held on assigned topics, and field examinations are made. The latter enter largely into the more practical part of the work. The entire course is pre-eminently practical in character.

601. Principles of Mining

Prerequisites: Courses 104, 201, 301.

Time: Junior year, first semester.

Lectures, five periods a week.

The following subjects are studied:

Mineral deposits, their classification from a mining standpoint and their irregularities as affecting the work of exploration and mining.

Prospecting by panning, trenches, test pits, boring and drilling. Testing of placers and ore deposits with well or chain drills.

Excavation of earth; tools; methods; supports.

Excavation of rock; explosives, kinds, nature, manufacture and use; methods of drilling and blasting, mammoth blasts; quarrying.

Machine drills: Construction and operation.

Tunneling: Methods of driving and timbering; permanent linings; sizes, speeds of advance and costs.

Boring: Methods and appliances for small depths and for deep boring; the diamond drill; survey of bore holes.

Shaft-sinking: Methods and tools for both hard and soft material; sinking; lining; handling and hoisting of material; timbering, walling and tubing.

Methods of support: Pillars, timbers, filling.

Surface-handling and transportation; arrangements for loading, unloading and storage of minerals; mineral railroads and common roads.

Ore extraction by systems of overhand and underhand stopping; caving by top slicing and sub-drifting; support of workings by filling and square-setting.

Underground haulage: Mine cars; arrangement of tracks; hand tramming; mule and rope haulage; gravity roads; steam, compressed air and electric locomotives.

Hoisting: Engines, drums, wire rope, skips and cages; head-frames; calculation of power required and methods of equalizing the load on the engine; devices for prevention of over-winding; shaft-sinking plant.

Arrangements at top and underground landings: Ore-pockets; signaling, etc.

Drainage: Buckets, tanks and head-pumps; Cornish and direct-acting underground pumps; operation of pumps by electricity, compressed air and hydraulic power.

Ventilation: Natural ventilation, underground furnaces, positive blowers and centrifugal fans; efficiency of fans.

Illumination: Candles; torches; lamps classified as oil, gasoline, magnesium, acetylene, electric and safety.

Accidents to men from fire-damp, dust explosions, mine-fires, falling material and inundations; prevention; rescue and relief.

Reference: *Young's Elements of Mining*.

Notes.

603. Ore Dressing

Prerequisites: Courses 104, 201, 702 accompanying.

Time: Senior year, first semester.

Lectures, four periods a week.

Laboratory, three periods a week.

This course includes a detailed study of severing by means of breakers, rolls, stamps and fine grinding machines; the sizing and classification of pulps by mechanical, pneumatic, and hydraulic processes; the principles and importance of sizing and classifying; the separation and concentration by hydraulic and electrical methods and also by means of flotation processes.

Reference: *Richards' Ore Dressing*.

604. Ore Dressing

Prerequisites: Courses 104, 201, 603.

Time: Senior year, second semester.

Lectures, three periods a week.

This course is a continuation of Course 603.

Reference: *Richards' Ore Dressing*.

605. Mine Examination

Prerequisites: Courses 701, 702, 502, 407, 408.

Time: Senior year, first semester.

Laboratory, four hours a week.

The main object sought in this course is to train the student sufficiently in expert mine examination work to enable him to report intelligently upon a mining proposition as to the advisability of purchase or of operation.

Practice is afforded in making regular reports, complete in every respect, on different kinds of mining properties. Each student is assigned a different mine or property to examine. In case the mine has been reported upon in previous years, detailed comparison of the results is afterwards made.

Among the more important topics usually considered are the topography of the district as an index to its accessibility, outside construction, the character of the geological formations, the geological structure (particularly as affecting the ore bodies), the character and disposition of the ores, the amount of ore developed, the probable extent of the unexplored part of the deposit, the best method of extracting the ore, of concentrating it, of preparing it for shipment or treating it immediately for the metal, the water facilities and the facilities for transportation to market. Full computations are required, including estimates of the cost of each process, of the necessary plant.

607. Mine Administration and Accounts

Prerequisites: Courses 407, 408, 502, 701, 702.

Time: Senior year, first semester.

Lectures, two periods a week.

Particular stress is laid on the business aspects of mining operations. The value of keeping tabulated record of different grades of work and its cost from day to day is urged as a means

of constantly reducing the fixed charges and of doing away with much of the extraordinary expenditures without reducing the efficiency of the work. The devising of methods of increasing the output with limited working forces is emphasized.

The subject of labor in its various phases, the details of supplies, mine accounts, statement of cost, and monthly reports are discussed.

608. Design of Mine Plant

Prerequisites: Course 603.

Time: Senior year, second semester.

Laboratory, three periods a week.

The student is assigned problems relating to a given mine. He makes the requisite surveys, plans the top-works, selects the requisite machinery for a special duty, and designs in detail and makes working drawings of those features of Hoisting, Haulage, or Drainage Plant, or of the Ore Handling Plant as may be assigned to him. On these portions he draws up specifications, bills of materials, and estimates of cost.

If an operating mine be selected for this, the entire work is examined, improvements incorporated, and suggestions made as to possible savings.

DEPARTMENT OF METALLURGICAL ENGINEERING

PROFESSOR SNYDER.

The aim of the Metallurgical Department is to give its graduates a thorough working knowledge of assaying, chemistry, mill-work and smelting processes; and to equip them with the knowledge necessary to the successful management of metallurgical plants, or to take charge of metallurgical operations.

This special training is given by lectures, reading, discussions, laboratory work and inspection of metallurgical plants.

701. Fire Assaying

Prerequisites: Courses 305, 306, 509, 510.

Time: Junior year, first semester.

Lectures, one period a week.

The instruction in assaying is given by means of lectures and laboratory experimentation, the practice in the laboratory illustrating the lecture-courses. The laboratory is well equipped with several different types of assay-furnaces for crucible work, scorification, and cupellation, and with everything that goes to make up a well furnished assay-office.

This course comprises fusion methods for gold, silver and lead. The crucible-assay of oxidized ores for gold and silver in the muffle and in the pot-furnace; crucible assay of sulphide ores for gold and silver by the iron, roasting, and preliminary fusion methods; also the crucible assay of lead ores. The scorification-assay of litharge and lead. In the assay of base-bullion, silver-assay of litharge and lead. In the assay of base-bullion, silver-bullion and gold-bullion, the methods in use in the United States mints are followed. Sampling and the preparation of the sample for assay; making cupels, and the management of the assay office and the special duties of practical assayers are considered.

Numerous samples are provided, all of which have been previously accurately assayed at the College, at the smelter whence

they came, or at the mint. The student works upon these until he attains a high degree of proficiency. No student is allowed to pass this subject until he has become an experienced assayer.

References: *Fulton's Manual of Fire Assaying*.

702. Fire Assaying Laboratory

Prerequisites: Courses 305, 306, 509, 510, 701.

Time: Junior year, second semester.

Laboratory, eight periods a week.

This course is the laboratory work of Course 701.

703. Principles of Metallurgy

Prerequisites: Courses 301, 509.

Time: Junior year, first semester.

Lectures, five periods a week.

A study of the physical and chemical properties of ore and metals as determinants in extraction-methods; furnaces, their classification and structure; fuels and thermal measurements; characteristic metallurgical processes; materials and products of metallurgical process; alloys; thermal treatment of metals preparatory to their use.

Particular stress is laid upon the study of the more recent metallurgical practices and improvements of older processes. The course is supplemented by visits to neighboring plants.

References: *Fulton, Principles of Metallurgy*,
Hofman, Principles of Metallurgy.

704. Metallurgy of Iron and Steel

Prerequisites: Courses 301, 509, 703.

Time: Junior year, second semester.

Lectures, five periods a week.

This course takes up the metallurgy of iron and steel in detail, in the following order, properties of iron, its alloys and compounds; specifications for standard iron and steels; ores of iron and the preparation of them for the blast furnace and its operation; manufacture of pig iron and its properties; calculation of furnace charges; chemistry of the blast furnace and the operation of same; blowing engines; furnace gases; treatment of flue dust; manufacture of steels by the basic and acid Bess-

emer processes; basic and acid Open Hearth processes; crucible steel manufacture; the making of wrought iron; structure of iron and steel; mechanical and heat treatment.

References: Stoughton, *Metallurgy of Iron and Steel*.

705. Metallurgy of the Non-Ferrous Metals

Prerequisites: Courses 703, 704.

Time: Senior year, first semester.

Lectures, five periods a week.

This course includes a study of the metallurgy of lead, copper, zinc, gold, silver, antimony, nickel, tin, bismuth, and tungsten. They are given in the order listed below:

Metallurgy of Gold and Silver

Occurrence of gold and silver; placer mining; the patio process; crushing and amalgamating machinery; pan amalagamation; chlorination by the vat and barrel process; cyaniding by the MacArthur-Forest and Siemens-Halske processes; modern methods of cyanide treatment of slimes by pressure and vacuum filters; lixiviation of silver ores; pyritic smelting; refining and parting of gold bullion.

Metallurgy of Copper and Lead

Occurrence of copper; roasting copper ores in heaps, stalls and roasting furnaces; blast-furnace smelting; pyritic smelting; reverberatory smelting; bessemerizing copper mattes; electrolytic refining of copper; selection of process and management of plant; occurrence of lead ores; methods of roasting and roasting furnaces; Corinthian, Silesian and English methods of reverberatory smelting; blast furnace smelting; calculation of blast furnace charges; and desilverization of base bullion, etc.

Metallurgy of Zinc and Minor Metals

This subject takes up the roasting of zinc ores; zinc distillation process; furnaces; purification of spelter; and commercial consideration of such metals. The metallurgy of Antimony, Nickel, Tin, Bismuth, Tungsten and Arsenic.

References: Rose, *Metallurgy of Gold*.

Collins, *Metallurgy of Silver*.

Peters, *Metallurgy of Copper*.

Ingalls, *Zinc*.

706. Metallurgy of the Non-Ferrous Metals

Prerequisites: Courses 703, 704, 705.

Time: Senior year, second semester.

Lectures, five periods a week.

This course is a continuation of Course 705.

708. Metallurgy Laboratory

Prerequisites: Courses 705, 706, 701.

Time: Senior year, second semester.

Lectures, one period a week.

Laboratory, eight periods a week.

Laboratory work and investigation will be conducted along some of the following lines: Amalgamation of ores of gold and silver, chlorination of gold and silver ores, cyanidation of gold and silver ores, leaching methods for copper ores, electrolytic refining for copper and lead, slags.

This work also includes the laboratory work to be done in Ore Dressing as listed in the Senior year, first semester, three hours a week.

Metallurgical Calculations

Prerequisites: Courses 703, 704.

Time: Senior year, first semester.

Lectures, one period a week.

A course based on Richard's Metallurgical Calculation. It is designed to bring the student in contact with the more important calculations in connection with the practice of thermo-chemistry and various smelting operations, also electro-metallurgy.

References: *Richards' Metallurgical Calculations*.

711. Metallurgical Plant Design

Prerequisites: Courses 415, 703.

Time: Senior year, first semester.

Lectures, one period a week.

Laboratory, six periods a week.

The student devotes his time to detailed and original plans for a plant for ore treatment. From year to year the conditions vary so that no two students have the same work. The working plans for part of the buildings, concentrators, furnaces, etc.,

are drawn up complete in every respect, the full bills of materials are made out for the portions of the work assigned, and the cost of the several parts carefully estimated according to the trade conditions and labor factors existing at the time. The entire work and all computations are carried out according to the best engineering practice and with the same care that actual construction operations require.

712. Metallurgical Plant Design

Prerequisites: Courses 415, 703, 711.

Time: Senior year, second semester.

Laboratory, six periods a week.

This is a continuation of Course 711.

713. Metallography

Prerequisites: Course 703.

Time: Senior year, first semester.

Lectures, two periods a week.

Laboratory, three periods a week.

This work is a course of lectures including the study of the micro-structure of iron and steel, of the non-ferrous metals, some commercial alloys and the influence of heat treatment, also mechanical, on these structures; the study of equilibrium and of the phase rule applied to alloys.

The laboratory work consists of the preparation and microscopical examination of the variously treated iron and steel alloys and the photographing of their structures; also the construction of equilibrium diagram of alloys.

714. Electro-Metallurgy

Prerequisites: Courses 703, 705.

Time: Senior year, second semester.

Lectures, two periods a week.

A series of lectures are given covering the electro-metallurgical processes in use at the present time as well as the necessary calculations of efficiency and engineering based on these.

Mining and Metallurgical Trips

During the Junior and Senior years occasional trips are taken to the mines, mills, and smelters which are within easy

reach of the School. The officials at the various plants have been uniformly courteous in allowing the School the opportunity to make these visits, and have placed at the disposal of the students everything essential to a clear understanding of the mode of operation.

The excursions give the student a chance to see in operation and practice what heretofore he may have known only theoretically and give him a command of the subject that cannot be obtained in the class room.

Among the properties visited and at the disposal of the School are:

The old Torrance and Merritt mines, three miles from the campus, in the Socorro Mountains. These mines were once rich producers, but are now being re-exploited.

The Merritt Mine has an incline shaft equipped with gasoline hoist and self-dumping skip, and a considerable amount of drifting, raises, winzes, and stopes. Practically all the operations of mining may be seen at these two mines.

The coal mines of Carthage, New Mexico, are within easy reach of the School and present to the student practical problems and their solution, in mining, haulage, ventilation, and water supply. The use of electricity in mining is prominently brought to the student's notice.

The zinc district at Kelley, New Mexico, brings out the fact that success in mining is not all luck. There are three large mines and three mills available for inspection, and the student sees in the mines that geology is a live subject and essential to successful mining. In the mills, he gets his first insight into ore dressing and learns that there is more than one way of doing the same thing.

The Southwestern Portland Cement Company's plant at El Paso is visited and studied from the mechanical point of view. Here are seen in action various types of crushers, grinders, elevators, conveyors, feeders, etc. The company's quarry is a fine example of open cut mining and the student sees the uses of churn drills in drilling holes for blasting large charges.

At the smelter in El Paso, the student sees the working and handling of a large custom plant. Practically everything in

the line of copper, lead, and silver smelting is before him for inspection. The methods of sampling, the blast roasting of lead ores, the roasting of copper ores, the blast furnace treatment of lead-silver ores, the blast furnace treatment of copper ores, the reverberatory smelting of copper ores, basic converting, casting machines, power houses, and assay offices are all made the subject of close observation.

ENGLISH AND SPANISH

The aim of the courses of instruction in this department is to train the student in the correct use of English and Spanish and to give facility in the writing and speaking of each.

801. Rhetoric and Composition

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, three periods a week.

A study of the theory of exposition, with special attention to the correct and effective sentence and the proper use of the paragraph. A definite amount of written work is required in order that the student may gain facility in the use of clear, idiomatic English. The subject matter for written work is frequently drawn from other courses pursued by the student, thereby correlating this work with that of other departments.

802. Rhetoric and Composition

Prerequisite: Course 801.

Time: Freshman year, second semester.

Lectures, three periods a week.

This course is a continuation of 801. More attention is given to punctuation and the writing of long themes. Oral expression and composition is a definite part of the class work. Reference reading is required.

803. Technical Business Forms and Reports

Prerequisites: Courses 801 and 802.

Time: Sophomore year, first semester.

Lectures, one period a week.

A study of the best methods of oral and written exposition of the details and problems of engineering and journalistic writing.

804. Technical Business Forms and Reports

Prerequisites: Courses 802 and 803.

Time: Sophomore year, second semester.

Lectures, one period a week.

This course is a continuation of Course 803. Practice is given in the writing of business letters and various reports of actual investigations made by the student.

805. Spanish

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, four periods a week.

The work is based on Worman's First and Second Spanish Readers. A part of the class exercise each day consists in cross-translations, both oral and written. Special stress is placed upon conversational exercises. Attention is given to the elementary principles of the grammar of the language with the idea of learning the grammar from the language rather than the language from the grammar.

806. Spanish

Prerequisites: Course 805.

Time: Freshman year, second semester.

Lectures, four periods a week.

A continuation of Course 805. It involves translations and prose writing and practice in oral expression. Emphasis is placed on the correct grammatical sentence.

807. Spanish

Prerequisite: Course 806.

Time: Sophomore year, first semester.

Lectures, three periods a week.

Alarcon's 'El Capitan Veneno' is read and the study of Spanish Grammar is pursued systematically, DeTornos' Spanish Grammar being used as reference. As much time as possible is devoted to conversation in Spanish.

808. Spanish

Prerequisite: Course 807.

Time: Sophomore year, second semester.

Lectures, three periods a week.

Valera's El Pajaro Verde is read and the study of Spanish grammar continued. The chief aim of the course is to give facility in the use of conversational Spanish.

ACADEMIC DEPARTMENT

PRINCIPAL GUNTER.

The minimum requirements for admission are one year of high school work consisting of at least one unit in English, one in algebra and one optional. The courses listed below are regularly given. Additional classes may be organized when there is sufficient demand for them.

The courses offered in the Academy are:

FIRST YEAR—FIRST SEMESTER

901. Elementary Algebra

Time: Five periods a week.

Texts: Hawkes, Luby and Touton.

A rapid review of the fundamental operations of algebra will be given during the first part of the semester. Factoring, fractions, linear equation, radicals and quadratics will be given special attention.

903. English II

Time: Five periods a week.

Texts: Brooks and Hubbard.

Classics: Standard English and American classics are read and discussed in class and the memorizing of some of the most significant passages is required. An attempt is made to cultivate a taste for good literature. Supplementary reading from approved authors is required.

Rhetoric: This deals with language as a medium through which ideas and thoughts are expressed. It includes Description, Narration, Exposition and Argumentation.

Composition: Ability to write English.

905. Plane Geometry

Time: Five periods a week.

Texts: Wentworth and Smith.

Triangles, quadrilaterals, loci, arcs, chords, measure of angles, and simple problems in construction are studied.

FIRST YEAR—SECOND SEMESTER**906. English II**

Time: Five periods a week.

Texts: Brooks and Hubbard, *Composition and Rhetoric*.

In this subject the work of the first semester is continued. The Merchant of Venice and Hamlet are read and discussed in class. As in the first semester, appropriate supplementary matter is read by each pupil.

908. Plane Geometry

Time: Five periods a week.

Texts: Wentworth and Smith.

Work of the first semester is continued. The course is vitalized by solutions of simple exercises and practical problems requiring the use of the algebra of the previous year.

910. Civics

Time: Five periods a week.

Text: To be selected.

Municipal, county, state and national forms of government are studied as they exist in the United States. Historical reports are required where these will aid in the understanding of the origin and growth of the various forms.

SECOND YEAR—FIRST SEMESTER**911. English III**

Time: Five periods a week.

Texts: Selected.

I. History of American Literature.

II. Ability to Write Formal Themes.

III. Knowledge of American Literature; Washington's Farewell Address; Webster's Bunker Hill Oration; One Essay From Emerson; Holmes' Poems (selected); Hawthorne's Short Stories, Marble Faun, or House of Seven Gables; Longfellow's Poems (selected); Lowell's Poems (selected); Short Stories From Poe; One Novel from Cooper.

An intensive knowledge of four of the above and a general reading knowledge of the others is required.

913. Physiography

Time: Five periods a week.

Text: Norton's *Elements of Geology*.

This course furnishes preparation for the college work to follow. It is largely geological. Erosion, the work of ground, water, rivers and valleys, the sea and its shores and movements of the earth's crust are studied. Laboratory work in which maps, rock formations, etc., are examined and studied is given in connection with the special topics.

915. Physics

Time: Four periods a week.

Laboratory, three periods a week.

Text: Millikan and Gale's *First Course in Physics* with laboratory manual.

This course runs throughout the entire year the aim being to familiarize the student with the principles of physics, and to serve as an introduction to applied mathematics. Attention is given to the preparation of records, and to the manipulation of apparatus. During this semester the subjects of mechanics, heat, and work are studied.

917. Ancient and Mediaeval History

Time: Five periods a week.

Text: To be selected.

The rise and fall of ancient and mediaeval nations to the close of the fifteenth century are studied. Careful attention is given to their forms of government and the causes of their rise and decadence.

SECOND YEAR—SECOND SEMESTER**918. English III**

Time: Five periods a week.

Text: Long, *English Literature*.

I. History of English Literature.

II. Ability to Write Formal Themes.

III. Knowledge of English Literature: Burke's Speech of Conciliation; Macauley's Life of Johnson; Shakespeare's Macbeth, Hamlet or King Lear.

920. Physics

Time: Class-room, three periods a week.

Laboratory, six periods a week.

Text: The same as in Course 915.

This is a continuation of the first semester's work. Sound, light, and electricity are treated in much the same manner as the subjects of the first half of the year. Throughout the course individual laboratory work is required. Each student must present a satisfactory note book of at least forty experiments performed by him during the year before credit will be allowed by instructor.

922. Solid Geometry

Time: Five periods a week.

Text: Wentworth and Smith, *Solid Geometry*.

The work for the second semester includes the usual theorems and constructions covering the relations of lines and planes in space; the properties and measurements of prisms, pyramids, cylinders, and cones; the sphere; and the spherical triangle.

924. Modern History

Time: Five periods a week.

Text: To be selected:

Beginning with the rise of modern nations at the close of the fifteenth century they will be studied to the present time. Special notice is given to the national motives of each nation, its form of government, etc.

Drawing

Instruction in elementary drawing is given to meet the requirement of the College for entrance into Freshman drawing.

Industrial Training

Elementary shop practice is given academic students. The scope and arrangement of shop work will be made by the instructor in charge. Students who do not intend to take a full college course will do well to take advantage of work in the shop.

GENERAL INFORMATION

EXPENSES

Matriculation Fee

A matriculation fee of five dollars is required of each new student before beginning work in the school for the first time and is paid only once.

Tuition Fee

The fee for tuition is five dollars a semester to residents of New Mexico and fifteen dollars a semester to non-residents. This is payable at registration, and payment after matriculation admits the student to all class-room instruction. Students who hold scholarships pay no fee for tuition.

Laboratory Fees

The laboratory fees are intended to cover the cost of materials for which the student does not pay directly and to compensate for the depreciation, due to use, in the value of the apparatus. These fees are payable at the time of registration for each subject and are as follows:

Chem. 301, General Chemistry.....	\$ 7.50
Chem. 304, Qualitative Analysis.....	7.50
Chem. 305, Quantitative Analysis.....	7.50
Chem. 306, Quantitative Analysis.....	7.50
Chem. 307, Water and Fuel Analysis.....	7.50
Chem. 308, Electro-Analysis.....	7.50
Chem. 312, Inorganic Preparation.....	7.50
Chem. 314, Organic Chemistry.....	7.50
Met. 702, Fire Assaying.....	20.00
Geol. 509 and 510, Mineralogy.....	6.00
Met. 708, Metallurgical Laboratory.....	3.00
C. E. 411, Shop.....	5.00
Phys. 201, Physics.....	4.00
Phys. 202, Physics.....	4.00
Phys. 203, Direct and Alternating Currents.....	5.00
Academy 915 and 920, Elementary Physics.....	3.00

School of Mines County Scholarships.—Scholarships are open to one student from each county in New Mexico. These scholarships yield free tuition and are awarded by the president to indigent and worthy students.

Allis-Chalmers Scholarships.—To one member of each year's graduating class there is offered by the Allis-Chalmers Company, manufacturers of mining and heavy machinery, with large works at Chicago, Milwaukee and Scranton, an opportunity for four months' study and employment in any of its plants and an emolument of \$150. This scholarship is awarded by the Board of Regents on the recommendation of the Faculty from those graduates of the year filing application before the 10th of June. The opportunity is an exceptional one to observe and study the building of all kinds of modern mining and metallurgical constructions.

ATHLETICS

Physical training has become a distinct feature of the student's activity at nearly all institutions of higher education. Rationally indulged in it is an exceedingly valuable feature, as is attested by past experience. The young man who gives promise of greatest usefulness, is sound in both mind and body. The health of the body and the consequent health of the mind cannot be promoted without proper attention to the laws of physical exercise. Physical training thus becomes, as it should become in an educational institution, a valuable means for the accomplishment of the very end and aim of the institution itself.

Care is taken, to make athletics merely a means of keeping the young men at the School of Mines in the best possible physical condition to do the work for which they came to the institution. While it accomplishes this purpose it naturally fosters and develops a strong college spirit, and this, too, is a species of enthusiasm that is by no means to be despised in the work of educating young men for the activities of their later years.

Athletics are encouraged and fostered in every reasonable way. Football, baseball and basketball teams have been supported at various times and have usually established good records.

Excellent tennis facilities are maintained for the use of the students.

BOYS' CLUB ROOM

A room in the dormitory 30 by 35 feet in size is fitted up as a Boys' Club Room. It is a general recreation room open at all times to the students of the School of Mines and is under the supervision of the Athletic Association. The room is supplied with furnace heat, an indirect lighting system and contains two pool tables, a piano, reading tables and comfortable chairs. In the future a fire place will be built, which will add to the comfortableness of the room.

The room has a very smooth floor which has been varnished and waxed, making it excellent for dancing. Several dances are given during the year by the students to their friends.

A dozen or more popular magazines are to be found here, together with the leading engineering magazines and daily news papers.

Not a more comfortable, cheery or home-like room will be found in any institution in the state.

The fitting up and furnishing of this club room has been made possible by the liberality of the Board of Regents, the generosity of the ladies of Socorro and the excellent co-operation of the student body.

METHOD OF GRADING

The following system of grading is used:

A—Excellent.

B—Good.

C—Fair.

D—Conditioned.

E—Failure.

Inc.—Incomplete.

Grades A, B, and C, carry credits.

D means student has not passed. The condition must be removed by passing a re-examination before the subject is re-

peated, otherwise it becomes an E. Only one re-examination will be permitted.

E means the subject must be repeated in class. At the discretion of the instructor an incomplete grade, designated "Inc." may be given the student for failing to finish a course, which must be removed before the subject is repeated in class, otherwise the incomplete becomes a failure.

CONDUCT OF STUDENTS

In the government of the School of Mines the largest liberty consistent with good work is allowed. Students are expected to conduct themselves as gentlemen upon all occasions and to show such respect for law, order, morality, personal honor, and the rights of others as is demanded of good citizenship. It is also hereby expressly stipulated that the use of intoxicating liquors, whether inside or outside the campus, and the frequenting of saloons and other places of questionable character are strictly prohibited. It is assumed that the act of registering as a student implies full acceptance of this policy. Failure on the part of any student to comply with this policy will be considered sufficient cause for removal from the institution.

SUMMER WORK

The proximity of the School to mineral properties, mines, and smelters makes it easy for the students to secure employment during the summer and at the same time to acquire much practical experience in the line of his profession. That this advantage has been appreciated is shown by the large proportion of students who yearly make use of this opportunity. During the past years, land-surveying, mine-surveying, geological surveying, assaying and mining, have been attractive fields of work for students during vacation.

CHEMICAL ANALYSIS, ASSAYING, AND ORE TESTING

The wide demand which exists in the great mining districts of the Southwest for disinterested and scientific tests and practical

investigations has led to the establishment by the New Mexico State School of Mines of a bureau for conducting commercial work relating to mining and metallurgy.

The performance of such work is made possible and accurate results assured by reason of the exceptional facilities of the laboratories of the School and the extensive practical experience of the instructors. The rapidly increasing amount of this work intrusted to the School is sufficient evidence in itself that the plan has been long needed to further the development of the mineral resources of the region.

A special act of the Legislature makes provision for carrying on commercial testing. The section from the law governing the School of Mines, Chapter 138, Section 38, Acts of 1889, reads: "The Board of Trustees shall require such compensation for all assays, analyses, mill-tests or other services performed by said institution as it may deem reasonable, and the same shall be collected and paid into the treasury of the School of Mines." By special resolution it is required that all charges shall be paid in advance. Prices for work will be sent on application.

FREE DETERMINATIONS

For the benefit of prospectors and others, elementary blow-pipe and physical tests will be made of any rocks, ores or other mineralogical material when sent to the School for their proper identification and classification. Such work is done to encourage prospecting and to more fully exploit the mineral resources of New Mexico so little comprehended at the present time. For such work as indicated in this paragraph no charges will be made.

**DIRECTORY OF GRADUATES
AND STUDENTS**

DIRECTORY OF GRADUATES AND STUDENTS †

ARTHUR H. ABERNATHY

Kelly, New Mexico

Student, 1898-1901. From Pinos, Zacatecas, Mexico. Assayer, Cananea Smelting Works, Cananea, Sonora, Mexico, 1901; Assistant sampler, Cia. Minera de Penoles, Mapimi, Durango, Mexico, 1909-1910; Sampling foreman same company, 1910-1914; Special student at New Mexico School of Mines, 1914-1915; Sampling foreman Cia. Minera de Penoles, Mapimi, Durango, Mexico, 1915-1916; Mine foreman, Ozark Mining and Smelting Co., Kelly, New Mexico, 1916—.

ANTONIO ABEYTA

Socorro, Mexico

(B. S. in Metallurgical Engineering, New Mexico School of Mines, 1914.)

Foreman at San Gertrudes Mine, Pachuca, Mexico, 1914-1916; Company I, U. S. Naval Training Station, San Francisco, Calif., 1917—.

RAY COOK AHNEFELDT

Riverside, California

Entered freshman class of Civil Engineering, 1913—.

EUGENE CARTER ANDERSON

Centerville, Mississippi

(B. S. in Mining Engineering, New Mexico School of Mines, 1917.)

Student, 1915-1917; U. S. Reclamation Service, 1917; Sergeant Company E, Twenty-third Regiment, U. S. Engineers—.

GEORGE C. BAER

Mogollon, New Mexico

(B. S. in Mining Engineering, New Mexico School of Mines, 1910.)

Student, 1907-1910. From Hillsdale, Michigan. Assayer, Tri-Bullion Company, Kelly, New Mexico, 1910; Millman, Socorro Mines Company, Mogollon, New Mexico, 1911; Mill foreman, same company, 1912; Engineer, same company, 1912; Assistant superintendent same company, 1914—.

PETER A. BALLARD

Rapid City, South Dakota

(B. S. in Mining Engineering, New Mexico School of Mines, 1916.)

Prospecting for oil in Wyoming, 1916-1918—.

JAMES HENRY BATCHELDER, JR.

Socorro, New Mexico

(B. S., New Mexico School of Mines, 1909; E. M., 1910.)

Student, 1906-1910. From Exeter, New Hampshire, Mining, Chloride, New Mexico, 1911; Farming, San Acacio, New Mexico, 1911—.

†Information concerning former students not here listed or concerning changes of address of those already listed will be gladly received.

THOMAS HORTON BENTLEY

Calgary, Alberta, Canada

(B. S., New Mexico School of Mines, 1909; E. M., 1910.)

Student, 1907-1910. From Burro Mountains, New Mexico. Surveyor with Mildon & Russell, Nacozari, Sonora, Mexico, 1910; General engineering work, Hermosillo, Sonora, Mexico, 1911; Mining engineer, Portland, Oregon, 1911; Assistant superintendent, Norton Griffiths Steel Construction Company of London, England, with headquarters at Vancouver, British Columbia, Canada, 1912; Superintendent, same company, with headquarters at Calgary, Alberta, Canada, 1912—.

JAMES FIELDING BERRY

Pachuca, Hilogdo, Mexico

Student, 1904-1905. From Socorro, New Mexico. Assayer, American Smelting & Refining Company, Aguascalientes, Mexico, 1905; Assayer, City of Mexico, Mexico, 1906-1907; Chemist, Cia Metalurgica y Refinadora del Pacifico, Fundicion, Sonora, Mexico, 1908; Assistant mine superintendent, American Smelting & Refining Company, Angangueo, Michiocan, Mexico, 1909-1914; Mine superintendent, San Gertrudes Company, Pachuca, Mexico, 1914-1918; Assistant superintendent same company, 1918—.

LOUIS AUGUST BERTRAND

Upland, Nebraska

Student, 1895-1896. From Conway, Iowa. Student, Ecole Professionalla de l'East, Nancy, Lorraine, 1890-1894; Instructor in Mathematics and French, New Mexico School of Mines, 1895-1896; Chemist, El Paso Smelting Works, El Paso, Texas; Assayer and surveyor, Consolidated Kansas City Smelting & Refining Company, Chihuahua, Mexico; Superintendent, Carmen Mines, Coahuila, Mexico; Mine superintendent, Cia. Minera de Penoles, Mapimi, Durango, Mexico, 1901-1903; Farming in Nebraska, 1903—.

ALEXANDER LOUIS BLACKBURN

Austin, Texas

Entered Sophomore class of Mining Engineering, 1915—.

H. LAWRENCE BROWN

Los Angeles, California

Student, 1903-1905. From Chicago, Illinois. Positions: Assayer, Ernestine Mining Company, Mogollon, New Mexico; Engineer, Cia. Concheno Beneficiador, Mexico; Mill superintendent, Milwaukee Gold Extraction Company, Phillipsburg, Montana; Engineer, Transvaal Copper Company, Sonora, Mexico; Manager, Morning Star Mining Company, Ophir, Colorado; Manager, San Carlos Mining Company, Sonora, Mexico; Manager of six properties and consulting engineer, Cobalt, Ontario, Canada; Superintendent, Haile Gold Mine, Kershaw, South Carolina; Exploration work in Venezuela, South America; Mill superintendent, National Mining Company, National, Nevada; at present, mining engineer with the American Metal Company with headquarters in Foster Building, Denver, Colorado.

PHILLIPE A. CAMPREDON

Gleason, Arizona

(B. S. in Metallurgical Engineering, New Mexico School of Mines, 1914.)

Assayer for Shannon Copper Company, Gleason, Arizona, 1915—.

PETER EDWARD CANNON

Roswell, New Mexico.

Student, 1916-1918; National Army, 1918—.

***R. HARLAND CASE**

Deming, New Mexico

Student, 1902-1905, from Cerrillos, New Mexico. Chemist, Compania Metalurgica de Torreon Coahuila, Mexico, 1905-1906; Assistant superintendent, Bonanza Mines, Zacatecas, Mexico, 1906; Assistant manager, Stephenson-Bennett Mining and Milling Company, Organ, New Mexico, 1906-1907; Consulting engineer, Western Mining, Milling & Leasing Company, Colorado Springs, Colorado, 1907-1908; Mining engineer, Deming, New Mexico.

WHATLEY L. CHANDLER, JR.

St. Louis Missouri

Student, 1916-1917; U. S. Engineering Corps, 1917—.

VIVIAN V. CLARK

Tucson, Arizona

Student, 1896-1898, from Kelly, New Mexico. Assayer, Bland Mining Company, Bland, New Mexico, 1898-1899; Superintendent, Navajo Gold Mining Company, Bland, New Mexico, 1900; Manager, Higuera's Gold Mining Company, Sinaloa, Mexico, 1901; Mine operator, Albuquerque, New Mexico, 1902; Manager Bunker Hill Mining and Smelting Company, Reiter, Washington, 1903-1908; Consulting engineer, Consolidated Exploration Mines Company of New York, and allied syndicates, 1909-1910; President, Northern Engineering Company, Seattle, Washington, 1910-1912; President, Clark Mining Machinery Company, successors to Northern Engineering Company, Seattle, Washington, 1912-1916; Consulting work, Tucson, Ariz., 1916-1918—.

DAVID JOSHUE CLOYD

Golconda, Arizona

Student, 1899-1900. From Decatur, Illinois. Chemist and assayer, Wardman's Assay Office, Aguascalientes, Mexico, 1900-1906; Assistant superintendent, Cia. Minera del Tiro General, and assistant superintendent, Cia del Ferrocarril Central de Potosi, Charcas, San Luis Potosi, Mexico, 1906-1908; Assayer and Chemist, Dailey, Wisner & Company, Torreon, Coahuila, Mexico, 1908; Chief assayer and chemist, Mazapil Copper Company, Saltillo plant, Saltillo, Coahuila, Mexico, 1911-1913; Shift boss in the Concentrating Mill, Union Basin Mining Company, Golconda, Arizona, 1915—.

SAMUEL COCKRILL

Indianapolis, Indiana

(B. S., New Mexico School of Mines, 1906.)

Student, 1904-1906. From North Fork, Virginia. Post-graduate engineering course, Allis-Chalmers Company, 1907-1908; Milwaukee Coke and Gas Company, Milwaukee, Wisconsin, 1908-1910; Citizens Gas Company, Indianapolis, Indiana, 1910—.

*Deceased.

HENRY A. COOK

Arlington, New Jersey

Entered Sophomore class 1916—.

HARRY H. DEVEREUX

Springfield, Illinois

Students, 1915-1917. First Lieutenant U. S. Aviation Service.

LEON DOMINION

New York, New York

(B. A., Roberts College, Constantinople, 1896; C. I. M., Mining School University of Liege, 1900.)

Graduate student, 1903-1904. From Constantinople, Turkey. Assistant, United States Geological Survey, 1903; Instructor in Mathematics, New Mexico School of Mines, 1903-1904; Engineer, Victor Fuel & Iron Company, Denver, Colorado, 1904-1906; Superintendent, Bonanza Mine, Zacatecas, Mexico, 1906-1907; Consulting engineer, Mexico City, Mexico, 1908-1909; Consulting engineer, New York City, in care of American Geographic Society, 1910-1918—.

ETHAN J. EATON

Socorro, New Mexico

Student, 1916-1917. Sergeant Company G, One Hundred and Forty-fourth U. S. Infantry—.

ALEXANDER WALTER EDELEN

Mexico City, Mexico

Student, 1905-1906. From Baltimore, Maryland. Assistant superintendent, Elkton Consolidated Mining & Milling Company, Elkton, Colorado, 1906-1907; Superintendent, Bonanza Mine, Zacatecas, Mexico, 1907-1908; Superintendent, American Smelting & Refining Company, Angangueounit, Michiocoan, Mexico, 1909-1918—.

THADDEUS BELL EVERHEART

Socorro, New Mexico

Student, 1905-1907. From Bells, Texas. Assayer and surveyor, Pereguina Mining and Milling Company, Guanajueto, Mexico, 1907-1908; Mill superintendent, Las Animas Mining and Milling Company, Pueblo Nuevo, Durango, Mexico, 1908-1910; Mining, Chloride, New Mexico, 1911-1913; Mining engineer, Socorro, New Mexico, 1914—.

THOMAS ALBERT FERGUSON

San Diego, California

Student, 1915-1917. U. S. Army, Company C, Eighth Field Signal Battalion—.

LEOPOLD E. FLEISSNER

Milwaukee, Wisconsin

(B. S., E. M. in Mining Geology, New Mexico School of Mines, 1912.)

Student, 1910-1912. From Manistee, Michigan. Engineer, Sterling Engineering & Construction Company, Milwaukee, Wisconsin, 1912-1913; Engineer, Ray Consolidated Copper Company, Ray Arizona, 1913-1918—.

HARRY THORWALD GOODJOHN

Torreon, Coahuila, Mexico

Student, 1902-1903. From Pittsburg, Texas. Assayer, Cia. Metalurgica de Torreon, Torreon, Coahuila, Mexico, 1903-1906; Chief chemist, Minera de Penoles Company, Mapimi, Durango, Mexico, 1906; Chemist and metallurgist, Cia. Minera, Fundidora, y Afinadora, Monterey, Mexico, 1907-1908; Chief chemist, Cia. Metalurgica de Torreon, Torreon, Coahuila, Mexico, 1909-1918—.

SAMUEL JAMES GORMLEY

Coquimbo, Chili

Student, 1895-1896. From Mt. Vernon, Iowa. Assistant professor of Engineering, New Mexico School of Mines, 1895-1896; Assistant assayer, Anaconda Copper Mining Company, Anaconda, Montana, 1897-1900; Chemist, same company, 1900-1902; Superintendent of sampling works, Washoe Smelting Company, Anaconda, Montana, 1902-1906; Smelter superintendent, Bingham Copper & Gold Mining Company, West Jordan, Utah, 1906-1916; Manager, Ore Trading Company's Smelter, 1916-1918—.

JOHN B. GUNTER

Belen, New Mexico

Entered, special student, 1914—.

EDWIN CLARENCE HAMMEL

Socorro, New Mexico

(B. S. in Geological Engineering, New Mexico School of Mines, 1917.)

Student, 1914-1917. Company A, Ninth U. S. Engineers, Mounted.

EDMUND NORRIS HOBART

El Paso, Texas

(B. S., New Mexico School of Mines, 1910.)

Student, 1906-1908; 1909-1910. From Clifton, Arizona. Chemist, Socorro Mines Company, 1909; Chief sampleman, Shannan Copper Company, Clifton, Arizona, 1910-1911; Assistant surveyor, American Smelting & Refining Company, Angangueo, Michiocoan, Mexico, 1911; Resident engineer, Capistante Mines Group, Mazapil Copper Company, Limited, Concepcion del Oro, Zacatecas, Mexico, 1912; Chief engineer, Charcas Unit, American Smelting & Refining Company, Charcas, San Luis Potosi, Mexico, 1913-1914; Mining engineer, Phelps-Dodge Company, Morenci, Arizona, 1914; Mining engineer, El Paso, Texas, 1915—.

CARL JOHN HOMME

Marshfield, Oregon

(A. B., St. Olaf College.)

Graduate student, 1899-1910. From Wittenburg, Wisconsin. Assayer and chemist, Candelaria Mining Company, El Paso, Texas, 1900-1901; Assistant superintendent, Gulf Creek Mining Company, Gulf Creek, New South Wales, Australia, 1902; Assayer, Glendale, Oregon, 1909-1913; Dispatching clerk in postoffice 1915—.

WILLIAM ELIAS HOMME

Glendale, Oregon

(A. B., St. Olaf College.)

Graduate student, 1902-1903. From Witeenburg, Wisconsin. Assayer, Gulf Creek Mining Company, Gulf Creek, New South Wales, Australia, 1903—.

HAYNES A. HOWELL

El Paso, Texas

Student, 1900-1905. From Socorro, New Mexico. Civil engineer on railway from Acapulco, Mexico, 1906-1907; Civil engineer, Mexican Central R. R., 1907-1912; Assistant to state engineer, Santa Fe, New Mexico, 1913-1917; Reclamation service, El Paso, Texas, 1917—.

JOHN AUGUST HUNTER

Toledo, Ohio

(B. S., New Mexico School of Mines, 1903.)

Student, 1899-1903. From Socorro, New Mexico. Chemist, Consolidated Kansas City Smelting Company, El Paso, Texas, 1903-1904; Chemist and metallurgist, American Smelting & Refining Company, Aguascalientes, Mexico, 1904-1908; Metallurgist, Congress Mining Company, Congress, Arizona, 1909-1910; Assayer, Los Angeles, California, 1910-1911; Engineer, Pioneer Mining Company, Tucson, Arizona, 1911-1912; Engineer, American Zinc Ore Separator Company, Denver, Colorado, 1912-1914; Mining engineer, Socorro, New Mexico, 1914-1915; Engineer for Cananea Copper Company, 1916; Chemist for By-Product Plant, Toledo, Ohio, 1916-1917; Captain, Company D, Three Hundred and Eighteenth U. S. Engineers, 1917—.

PABLO INGUNZA

Lima, Peru, S. A.

Entered Freshman class in 1917—.

FRANK A. JOHNSTON

New Bloomfield, Pennsylvania

Entered, 1911, from New Bloomfield, Pennsylvania. Secured B. S. degree in Civil Engineering, 1913—.

LEON WILLIAM KELLY

Montrose, Pennsylvania

(B. S. in Mining Engineering, New Mexico School of Mines, 1917.)

Student, 1915-1917. Research department, International Smelter Company, Tooele, Utah, 1917; Company G, Third Officers' Training Camp, Camp Lewis.

FREDERICK KRUG

San Juancito, C. A.

Student, 1917-1918. Assistant Electrician, New York and Honduras Rosaria Mining Company.

CHARLES THAYER LINCOLN

New York, New York

(B. S., Massachusetts Institute of Technology, 1901.)

Graduate student, 1902-1903. From Boston, Massachusetts. Chemist, Bell Telephone Company, 1901-1902; Assistant in Analytical Chemistry, New Mexico School of Mines, 1902-1903; Acting professor, same, 1903-1904; Instructor in Chemistry, Iowa State University, Iowa City, Iowa, 1904-1905; Chemist, Hartford Laboratory Company, Hartford, Connecticut, 1905-1907; Chemist, Arbuckle Brothers Sugar Refinery, Brooklyn, New York, 1907-1909; Chemist, United States Custom Service, New York, 1910—.

FRANCIS CHURCH LINCOLN

Reno, Nevada

(B. S., Massachusetts Institute of Technology; E. M., New Mexico School of Mines, 1903.)

Assayer, San Bernardino Mining Company, 1900; Chemist, Butterfly Terrible Gold Mining Company, 1900-1901; Professor of Metallurgy, New Mexico School of Mines, 1902-1904; Assistant superintendent, Ruby Gold & Copper Company, Ortiz, Sonora, Mexico, 1904; General

manager, Arizona Gold & Copper Company, Patagonia, Arizona, 1904; Professor of Geology, Montana School of Mines, Butte, Montana, 1907-1910; Consulting engineer, New York City, 1910-1911; Assistant professor of Mining, University of Illinois, Urbana, Illinois, 1911-1913; Resident engineer, Bolivian Dev. & Exp. Co., La Paz, Bolivia, 1913-1914; Director Mackay School of Mines, University of Nevada, 1914-1918—.

HORACE T. LYONS

Globe, Arizona

(B. S. in Mining Engineering, New Mexico School of Mines, 1913.)

Mining engineer at Miami, Arizona, 1913-1914. Now at Ajo, Arizona, in moving picture theatre.

HARRY C. MAGOON

Chicago, Illinois

Student, 1899-1900. From Chicago, Illinois. Engineer, Illinois Steel Company, Chicago, Illinois, 1911-1918—.

FRANK MALOIT

Tucson, Arizona

(B. S. in Mining Engineering, New Mexico School of Mines, 1914.)

Mining engineer at Lordsburg, 1914-1915; Superintendent, San Xavier mine, The Empire Zinc Company, 1916-1918—.

HUGO MAREK

Clovis, New Mexico

Entered Freshman class in 1916—.

JOHN B. McDONALD

Albuquerque, New Mexico

Academic Department, 1914-1916; Freshman class, 1916-1917; National Army, 1917—.

JOHN A. McKINNON

Silver City, New Mexico

Entered Freshman class in 1916—.

ROY SYLVESTER McVEIGH

Kelly, New Mexico

Entered Freshman class in 1917—.

DANIEL M. MILLER

Lake Valley, New Mexico

(B. S., New Mexico School of Mines, 1909.)

Chemist, Lake Valley Mines Company, Lake Valley, New Mexico.

TARVER MONTGOMERY

Santa Ana, California

Student, 1899-1900. From Santa Ana, California. County surveyor, Orange county, California, 1900-1901; Assistant engineer, Temescal Water Company, Corona, California, 1901; Transitman, San Pedro, Los Angeles & Salt Lake Railroad Company, 1901-1902; Assistant engineer, Pacific Electric Railroad Company, Santa Ana, California, 1902—.

GENOVEVO MONTOYA

Kelly, New Mexico

Entered Freshman class in 1917—.

WILLIAM ESTILL MOORE

Lexington, Kentucky

Student, 1915-1917; Lieutenant, U. S. Aviation Service—.

EARLE GIBBON MORGAN

Guadalajara, Jalisco, Mexico

(E. M., New Mexico School of Mines, 1911.)

Student, 1907-1908, 1910-1911. From Landsdowne, Pennsylvania.

Pennsylvania State College, 1908-1910. Engineer, Socorro Mines Company, Mogollon, New Mexico, 1911-1912; Assistant engineer, same company, Guadalajara, Jalisco, Mexico, 1912—.

ERLE D. MORTON

Mammoth, Arizona

(E. M. in Mining Geology, New Mexico School of Mines, 1909.)

Student, 1903-1905, 1908-1909. From Los Angeles, California, Assistant superintendent, Giroux Consolidated Mines Company, Kimberly, Nevada, 1905-1906; Washington University, 1906-1907; Mine examiner, Los Angeles, California, 1907-1908; Surveyor, Ampara Mining Company, Etzatlan, Jalisco, Mexico, 1908; Mine superintendent, Arizona & Nevada Copper Company, Luning, Nevada, 1909-1910; Mining engineer, Los Angeles, California, 1910; Chief engineer, Lone Mountain Tunnel Company, Superior, Montana, 1911-1912; With Braun Corporation, Los Angeles, California, 1912-1913; Assistant superintendent, Elko-Prince Mining, Gold Circle, Elko County Nevada; Assistant superintendent Mammoth mine, Mammoth, Arizona, 1916-1918—.

WILLIAM FREDERICK MURRAY

Gallup, New Mexico

Student, 1904-1906. From Raton, New Mexico. In chief engineer's office, Victor Fuel Company, Denver, 1906-1907; Assistant engineer, Victor Fuel Company, 1907-1908; Assistant to chief and traveling engineer, Victor Fuel Company and Colorado & Southern Railway Company, 1908; Assistant engineer, Hastings Mine, Victor Fuel Company, Hastings, Colorado, 1909-1910; Superintendent, Cass Mine, Victor-American Fuel Company, Delagua, Colorado, 1910-1913; Assistant general superintendent, Victor-American Fuel Company, Gallup, New Mexico, 1913-1918—.

HORATIO S. NOWAK

Milwaukee, Wisconsin

Student, 1915-1917. Lieutenant, U. S. Infantry.,

MARTIN J. O'BOYLE

Mogollon, New Mexico

(B. S. in Mining Engineering, New Mexico School of Mines, 1914.)

Mining engineer for the Socorro Mines Company, Mogollon, New Mexico, 1914—.

JOHN F. O'NEILL

San Diego, California

Student, 1916-1917. Flying Cadet, U. S. Aviation Service, Lovefield, Dallas, Texas.

ORESTE PERAGALLO

Tepec, Mexico

(E. M., New Mexico School of Mines, 1908.)

Student, 1907-1908. From Ciudad Jaurez, Chihuahua, Mexico. Mining engineer, El Paso, Texas, 1908-1910; Graduate student, New Mexico School of Mines, 1910-1911; Mining engineer, El Paso, Texas, 1911-1912; Chemist, Tepec, Mexico, 1912-1914; Mining engineer, San Diego, California, 1915—.

PAUL PETERSON

Owatonna, Minnesota

Entered Freshman class in 1916—.

EWIN PRATHER

Lake Arthur, New Mexico

Student, 1916-1917. Sergeant Co. A, 143 Machine Gun Battalion, U. S. Army.

DANIEL FRANCIS RECKHART

El Paso, Texas

Student, 1913-1917. Naval Service, U. S. S. Michigan, 1917—.

ALBERT BRONSON RICHMOND

Tucson, Arizona

Student, 1900-1901. From Las Prietas, Sonora, Mexico. Superintendent, Ramona Mill Company, Gabilan, Sonora, Mexico, 1901-1902; Assayer, Patagonia Sampling Works, Patagonia, Arizona, 1902; Assayer and metallurgist, Patagonia, Arizona; General manager, Mansfield Mining & Smelting Company, Patagonia, Arizona, 1908; Consulting engineer, Tucson, Arizona, 1909; Field engineer, Mines Company of America with headquarters at Tucson, Arizona, 1910-1918—.

DELL FRANK RIDDELL

Parral, Chihuahua, Mexico

(Ph. C., Chicago College of Pharmacy, 1896; B. S., Nebraska State University, 1901; E. M., New Mexico School of Mines, 1905.)

Graduate student, 1903-1905. From Sioux Falls, South Dakota. Professor of Chemistry, Sioux Falls College, Sioux Falls, South Dakota, 1901-1903; Instructor in Chemistry, New Mexico School of Mines, 1903-1904; Acting professor of assaying, same, 1904-1905; Holder of Allis-Chalmers Scholarship, 1905-1906; Engineer, Universal Pump & Manufacturing Company, Kansas City, Missouri, 1906-1907; Superintendent, Benito Juarez Mine, Parral, Chihuahua, Mexico, 1907-1908; Consulting engineer and acting superintendent, Providentia Mines Company, Parral, Chihuahua, Mexico, 1908-1916; Mine superintendent, Ajo, Arizona, 1916-1918—.

SOREN RINGLUND

Socorro, New Mexico

(B. S. and E. M. in Mining Geology, New Mexico School of Mines, 1912.)

Student, 1910-1912. From Ceresco, Nebraska. Engineer, The Empire Zinc Company, Kelly, New Mexico, 1912-1914; Mining geologist, The Empire Zinc Company, 1915—.

ORLANDO DOUGLAS ROBBINS

Depue, Illinois

(B. S. and E. M., New Mexico School of Mines, 1909.)

Student, 1905-1909. From Louisville, Kentucky. Chemist, El Chino Copper Company, Santa Rita, New Mexico, 1909-1910; Mill superintendent, Germania Mining Company, Springdale, Washington, 1910; Chief sampler, Inspiration Copper Company, Globe, Arizona, 1910; Engineer, United States Steel Company, Depue, Illinois, 1911-1913; Chief of ore and testing department of Mineral Point Zinc Company, Depue, Illinois, 1914-1918—.

CECIL ROWE

Arden, Nevada

Entered Freshman class 1917—.

GEORGE L. ROSALES

Lordsburg, New Mexico

Entered Academic Department 1916—.

JULIUS SANCHEZ Socorro, New Mexico
(B. S. in Geological Engineering, New Mexico School of Mines, 1917.)
Student, 1912-1914, 1915-1917. Lieutenant, Signal Reserve Corps,
U. S. Aviation Service.

MANUEL A. SANCHEZ Mora, New Mexico
(B. S. in Civil Engineering, New Mexico School of Mines, 1917.)
Student, 1914-1917. United States Geological Service, 1917—.

CHARLES S. SHAMEL Seattle, Washington
(B. S., M. S., University of Illinois; LL. B., University of Michigan;
A. M., Ph. D., Columbia University.)
Graduate student, 1901-1902. Mining lawyer, Seattle, Washington.

RAYMOND M. SHERIDAN Milwaukee, Wisconsin
Entered Freshman class 1916—.

JAMES AVERY SMITH Socorro, New Mexico
Entered, 1908, from Socorro, New Mexico. B. S. Degree in Metallurgical Engineering, 1913; Assayer and sampler, Inspiration Copper Company, Miami, Arizona, 1913-1916; On oil flotation, Smuggler Union Mine, Telluride, Colorado, 1916; Oil flotation engineer in California and at Clifton, Arizona, 1916-1917; Corporal, Company C, Eighteenth Regiment U. S. R. R. Engineers.

OLIVER RUSSELL SMITH Naches, Washington
(B. S., Kansas College of Agriculture and Mechanic Arts, 1908; C. E.,
New Mexico School of Mines, 1902.)

Graduate student, 1898-1901. From Manhattan, Kansas. B. S. in Civil Engineering, New Mexico School of Mines, 1902; Assistant in Mathematics and Draughting, New Mexico School of Mines, 1900-1901; Instructor in Engineering and Drawing, same, 1901-1902; Assistant professor in Engineering and Drawing, same, 1902-1903; Assistant surveyor, U. S. General Land Office, 1902; City engineer, Socorro, New Mexico, 1902; Deputy mineral surveyor, U. S. General Land Office, 1903; Professor of Civil Engineering, New Mexico School of Mines, 1903-1907; Civil engineer, Santa Fe Railway, San Bernardino, California, 1907-1908; Engineer United States Reclamation Service, Zillah, Washington, 1908-1918—.

HOWARD STECH Rushville, Indiana
Entered Freshman Class 1917—.

PAUL E. M. STEIN El Paso, Texas
(B. S., New Mexico School of Mines, 1911; E. M. in
Mining Geology, 1912.)

Student, 1907-1912. From Davenport, Iowa. Assistant engineer, Socorro Mines Company, Mogollon, New Mexico, 1912; Chemist, El Paso plant, Kansas City Consolidated Smelting and Mining Company, El Paso, Texas, 1912-1917; Assistant superintendent, 1917-1918—.

KARL AKSEL STRAND

Hanover, New Mexico

(B. S. and E. M. in Mining Geology, New Mexico School of Mines, 1912.)

Student, 1906-1912. From Socorro, New Mexico. Ore classifier, Utah Copper Company, Garfield, Utah, 1912; Draughtsman, same, 1912-1913; Mine superintendent, The Empire Zinc Company, Hanover, New Mexico, 1914-1918—.

LEO RICHARD AUGUST SUPPAN

St. Louis, Missouri

(B. S. in Chemistry and Metallurgy, New Mexico School of Mines, 1896.)

Student, 1895-1896. From St. Louis, Missouri. Instructor in Chemistry, New Mexico School of Mines, 1895-1897; Graduate student, Johns Hopkins University, Baltimore, Maryland, 1897; University of Warburg, Germany, 1898; Professor of Chemistry, Marine-Sims College, St. Louis, Missouri, 1898; Associate professor of Pharmaceutical Chemistry, St. Louis College of Pharmacy, 1913—.

OTTO JOSEPH TUSCHKA

Monterey, Nuevo Leon, Mexico

(E. M. in Metallurgical Engineering, New Mexico School of Mines, 1897.)

Student, 1893-1897. From Socorro, New Mexico. Assayer and chemist, Graphic Smelting Works, Magdalena, New Mexico, 1897-1898; Graduate student, New Mexico School of Mines, 1898-1899; Assistant sampling mill foreman and chemist, Guggenheim Smelting & Refining Company, Monterey and Aguascalientes, Mexico, 1899-1900; Assayer, Seamon Assay Laboratory, El Paso, Texas, 1900; Chief chemist, Compania Minera, Fundidora, y Afinadora, "Monterey," Monterey, Nuevo Leon, Mexico, 1900-1916; Engineer, Old Dominion Copper Company, 1916-1918—.

LAURENCE P. WELD

Thompson, Nevada

(B. S. and E. M., New Mexico School of Mines, 1912.)

Student, 1908-1912. From Rochester, New York. Concentrator man, Original Amador Mines Company, Amador City, California, 1912-1913; Assistant engineer and chemist, same company, 1913; Smelter electrician, Mason Valley Mines Company, Thompson, Nevada, 1913—.

MILTON BENHAM WESTCOTT

Monterey, Nuevo Leon, Mexico

Student, 1904-1905. From Chicago, Illinois. Engineering corps, Santa Fe Railway, 1905; Assistant county surveyor, El Paso county, Texas, 1906-1907; Assistant engineer, Monterey Railway, Light and Power Company, Monterey, Nuevo Leon, Mexico, 1907; Assistant engineer, Monterey Water-works and Sewer Company, Monterey, Nuevo Leon, Mexico, 1907-1908; Resident engineer, same, 1908-1913; Construction engineer, Nelson, B. C., 1913-1918—.

GLENN H. WICHMAN

Los Angeles, California

Student, 1916-1917; U. S. Engineering Corps, 1917—.

WAKELEY A. WILLIAMS Grand Forks, British Columbia, Canada

Student, 1893-1894. From Council Bluffs, Iowa. Assistant superintendent, Granby Consolidated Mining, Smelting and Power Company,

Limited, Grand Forks, British Columbia, Canada, 1898. At present superintendent of same.

CARLOS WILLIAMS

Nashville, Arkansas

Entered Freshman class 1917.

FOREST WINGFIELD

Alamogordo, New Mexico

Entered Freshman class 1916—.

JAMES YATES

Gallup, New Mexico

Entered Freshman class 1916—.

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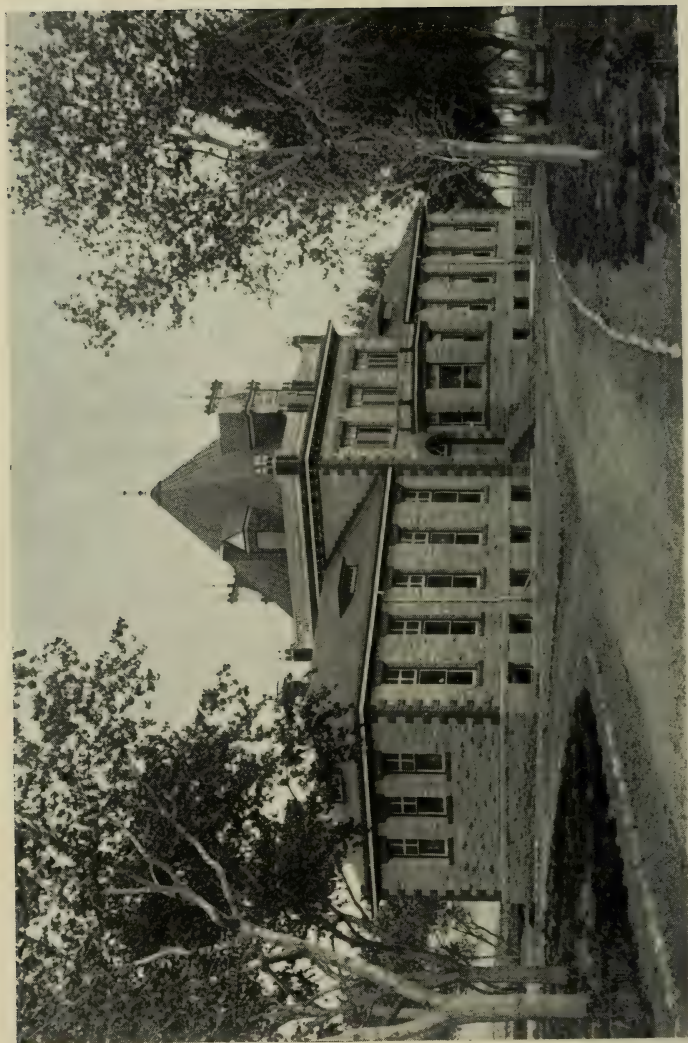
NEW MEXICO
STATE
SCHOOL OF MINES

SOCORRO, N. M.



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With Announcements for 1920-1921



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SCHOOL CALENDAR

1920

First Semester:

September 7, Tuesday—Registration of students.

September 8, Wednesday—Class work begins.

September 27—"M" Day.

November 11—Armistice Day.

November 25, 26 and 27—Thanksgiving Recess.

December 23, Thursday, 4. P. M.—Holiday recess begins.

1921

January 3, Monday—Work resumed.

January 10, 11, 12, 13, 14—Examinations.

Second Semester:

January 17, Monday—Registration.

January 18, Tuesday—Class work begins.

February 22, Washington's Birthday—Holiday.

May 12, 13, 16, 17, 18—Final Examinations.

May 19—Commencement.

BOARD OF REGENTS

P. H. ARGALL, <i>Manager Ozark Sm. and M. Co.</i>	Magdalena
J. M. SULLY, <i>Manager Chino Copper Co.</i>	Hurley
C. T. BROWN, <i>S. W. Supt. The Empire Zinc Co.</i>	Socorro
W. A. PARVIS, <i>M. D.</i>	Socorro
C. C. CLARKE, <i>D. D. S.</i>	Socorro

The complete board is as follows:

HIS EXCELLENCY, O. A. LARRAZOLO, <i>Governor of New Mexico, ex-officio</i>	Santa Fe
HON. J. H. WAGNER, <i>Superintendent of Public Instruction, ex-officio</i>	Santa Fe
P. H. ARGALL	Magdalena
J. M. SULLY	Hurley
C. T. BROWN	Socorro
W. A. PARVIS, <i>M. D.</i>	Socorro
C. C. CLARKE, <i>D. D. S.</i>	Socorro

OFFICERS OF THE BOARD

P. H. ARGALL	President
C. T. BROWN	Secretary and Treasurer
BLANCHE REED	Clerk of Board

FACULTY

ALEXIS XAVIER ILLINSKI...*President and Professor of Chemistry*

B. S. in Chemistry and Metallurgy, School of Mines and Metallurgy, University of Missouri, 1909; Met. E., School of Mines and Metallurgy, University of Missouri, 1916; Superintendent of Underground Diamond Drills, Federal Lead Company, Flat River, Missouri, 1906-7; Superintendent of Canvas Plant, Federal Lead Company, Flat River, Missouri, 1907-08; Chemist, Missouri Geological Survey, Rolla, Missouri, 1909-12; Instructor in Metallurgy and Ore Dressing, School of Mines and Metallurgy, Rolla, Missouri, 1912-14; Experimental Research Station, School of Mines and Metallurgy, Rolla, Missouri, 1914-15; Professor of Chemistry, New Mexico State School of Mines, 1915-17; President and Professor of Chemistry, New Mexico State School of Mines, 1917—

EDGAR HERBERT WELLS...*Professor of Geology and Mineralogy*

E. M. University of North Dakota, 1900; Assistant Engineer, Daly West Mine, Park City, Utah, 1909; Mining and leasing operations, Daly West and Daly-Judge Mines, Park City, Utah, 1910-11; Engineer and Draftsman, Canadian Collieries (Dunsmuir) Ltd., Cumberland, B. C., 1912-14; Instructor in Mathematics, Geology, Mineralogy and Physical Education, Tintic Mining High School, Eureka, Utah, 1914-16; Instructor in Mathematics and Physical Education, West Side High School, Salt Lake City, Utah, 1916-17; Assistant Superintendent, Austin-Dakota Mining Co., Austin, Nevada, 1917; Professor of Geology and Mineralogy, New Mexico State School of Mines, 1917—

RICHARD HERB REECE....*Professor of Mathematics and Physics*

B. S. in Electrical Engineering, Kansas State Agricultural College, 1906; Graduate student at University of Wisconsin, 1916; Telephone Engineer with Western Electric Co., Chicago, 1906-08; Principal of High School, Champion, Mich., 1908-10; Instructor in Mathematics, Michigan Agricultural College, 1910-17; Professor of Mathematics and Physics at the New Mexico State School of Mines, 1917—; Member of the Mathematical Association of America.

BYRON JOHN SNYDER.....*Professor of Mining and Metallurgy*

B. S. in Chemistry and Metallurgy, School of Mines and Metallurgy, University of Missouri, 1907; Met. E., School of Mines and Metallurgy, University of Missouri, 1910; Assistant in Chemistry, Missouri School of Mines and Metallurgy, 1904-06; Instructor in Chemistry, Missouri School of Mines and Metallurgy, 1907-08; Chemist Research and Analytical Laboratory, Mallinckrodt Chemical Works, St. Louis, Mo., 1908-10; Director of Mining Department and Professor of Mining Engineering and Metallurgy, North Georgia Agricultural College, University of Georgia, 1910-17; Professor of Mining and Metallurgical Engineering, New Mexico State School of Mines, 1917—

ANDREW MERRITT OCKERBLAD *Professor of Civil Engineering*

B. S. in Civil Engineering, University of Vermont, 1910; Instructor in Civil Engineering, Michigan Agricultural College, 1910-13; Examiner of Surveys U. S. Forest Service, Washington, D. C., 1913-17; Civil Engineer in charge of department for the Wichita Mapping and Engineering Company, Wichita, Kansas, 1917; Instructor in Civil Engineering, Throop College of Technology, 1917; First Lieutenant Engineers, U. S. A., 1917-19; Civil Engineer U. S. Naval Ordnance Plant, South Charleston, W. Va., 1919; Professor of Civil Engineering, New Mexico School of Mines, 1919—

WALLACE DUNCAN REYNOLDS *Professor of English and Spanish*

Colegio Internacional, 1910; Ph. B. Meridian College, 1912; M. Ped. Meridian College, 1913; A. M. University of Little Rock, 1915; Instructor of Spanish, Meridian College, 1910-13; Professor of Languages, Laredo Seminary, 1913-14; Professor of Languages, South Texas Normal Summer, 1914; Professor of Latin and Spanish, Nebraska State Normal School, 1916-18; Professor of English and Spanish, New Mexico School of Mines, 1919—

MATT FOWLER *Lecturer in Mining Law*

LL. B. Grant University, 1905. LL. B. University of Illinois, 1907. Member of Bar of Illinois, Tennessee, New Mexico and Federal Courts.

HENRY AXEL COOK *Principal Academic Department*

B. S. in Metallurgy, New Mexico State School of Mines, 1919; Principal of Academic Department, New Mexico State School of Mines, 1919—

PAUL FUNDERHIDE *Assistant Professor Civil Engineering*

B. S. in C. E., North Dakota Agricultural College, 1911; Instrument man on Drainage, U. S. Department of Agriculture, 1905-06; Instrument man on Drainage, U. S. Geological Survey, 1906; Chief of Party on Drainage, U. S. Department of Agriculture, 1907; Chief of Party on Drainage and Topography, U. S. Geological Survey, 1907-8; maintained a private Civil Engineering and Architectural Office at Chester, Montana, 1911-15; County Highway Engineer, Towner County, North Dakota, 1916; Drainage Assistant, U. S. Department of Agriculture, 1919; Assistant Professor of Civil Engineering, New Mexico State School of Mines, 1920—

BLANCHE REED *Registrar and Librarian*

ORGANIZATION

The New Mexico State School of Mines includes the College of Engineering and the Academy.

COLLEGE OF ENGINEERING

In the College of Engineering the following courses are offered:

- I. Mining Engineering.
 - II. Metallurgical Engineering.
 - III. Geological Engineering.
 - IV. Civil Engineering.
 - V. General Science.
-

THE ACADEMY

The Academy offers instruction in certain subjects required for entrance to the College of Engineering.

NEW MEXICO STATE SCHOOL OF MINES

HISTORICAL SKETCH

The New Mexico State School of Mines was founded by Act of the Legislature of 1889. The Act provided for the support of the School by an annual tax of one-fifth of a mill on all taxable property.

Under an Act of the Legislature, approved February 28, 1891, a board of trustees was appointed. Organization was effected and immediate steps were taken towards the erection of necessary buildings. In the same year a special appropriation of \$4,000 was made for the partial equipment of the chemical and metallurgical laboratories.

Early in 1892 a circular of information regarding the New Mexico School of Mines at Socorro, New Mexico, was issued by the Board of Trustees. In this circular the aims of the institution were fully set forth. The following year a president was chosen and students in chemistry were admitted but it was not until the autumn of 1895 that the mining school was really opened.

In 1893 a second special appropriation of \$31,420 was made to enable the School of Mines to be organized in accordance with the policy outlined by the Act creating the institution.

By Act of Congress, approved June 21, 1895, the New Mexico School of Mines received for its share of certain grants of land fifty thousand acres for its support and maintenance. From this source of revenue the school has already received more than \$40,000.

In 1899 the Legislature increased the former levy of one-fifth of a mill to twenty-seven and one-half one-hundredths of a mill.

In 1901 the Thirty-fourth General Assembly recognized the growing importance of the School by further increasing the tax levy to thirty-three one-hundredths of a mill. It also authorized

the bonding of any portion of the grants of lands in order to more thoroughly equip the School with buildings and apparatus.

In 1903 the Thirty-fifth General Assembly raised the millage to forty-five one-hundredths of a mill. This, with greatly increased assessed valuation of property, doubled the income of the school over that of the previous year.

Since 1903 the appropriation for the support and maintenance of the School of Mines has been increased at each session of the General Assembly. At the first session of the State Legislature the appropriation was raised to \$22,500 a year.

The Second State Legislature of 1915 provided the additional fund of \$20,000 for machinery and metallurgical and ore dressing equipment.

By the terms of the Enabling Act under which New Mexico was admitted to statehood, the School of Mines becomes possessed of an additional 150,000 acres of land. Most of this land has now been selected and will soon become the source of a very considerable revenue to the institution.

STATUTES RELATING TO THE SCHOOL

Some of the sections of the Act creating the School of Mines are as follows:

The object of the School of Mines created, established and located by this Act is to furnish facilities for the education of such persons as may desire to receive instruction in chemistry, metallurgy, mineralogy, geology, mining, milling, engineering, mathematics, mechanics, drawing, the fundamental laws of the United States and the rights and duties of citizenship, and such other courses of study, not including agricultural, as may be prescribed by the Board of Trustees.

The management and control of said School of Mines, the care and preservation of all property of which it shall become possessed, the erection and construction of all buildings necessary for its use, and the disbursement and expenditure of all moneys appropriated by this Act, or which shall otherwise come into its possession, shall be vested in a board of five regents, who shall be qualified voters and owners of real estate; and said regents shall possess the same qualifications, shall be appointed in the same way, and their terms of office shall be the same, vacancies

shall be filled in like manner, as is provided in Sections 9 and 10 of this Act. Said regents and their successors in office shall constitute a body under the name and style of "The Board of Regents of the New Mexico School of Mines," with right as such of suing and being sued, of contracting and being contracted with, of making and using a common seal and altering the same at pleasure, and of causing all things to be done necessary to carry out the provisions of this Act. A majority of the board shall constitute a quorum for the transaction of business, but a less number may adjourn from time to time.

The board of regents shall have power to confer such degrees and grant such diplomas as are usually conferred and granted by other similar schools.

The regents shall have power to remove any officer, tutor, instructor or employe connected with said School when, in their judgment, the best interests of said School require it.

The board of regents shall require such compensation for all assays, analyses, mill-tests, or other services performed by said institution as they may deem reasonable, and the same shall be collected and paid into the treasury of the School of Mines for said institution, and an accurate account thereof shall be kept in a book provided for that purpose.

LOCATION

The New Mexico State School of Mines is located at Socorro, the county seat of Socorro County, on the main line of the Atchison, Topeka and Santa Fe Railway, 75 miles south of Albuquerque, and 180 miles north of El Paso. The Magdalena branch of the Santa Fe railway starts from this place.

Socorro is situated in the valley of the Rio Grande at the foot of the Socorro range of mountains at an elevation of 4,600 feet above the level of the sea. The surrounding scenery is diversified by plains, valleys, mesas, hills, and mountains. The climate of the locality is preeminently pleasant and healthful, and has long attracted health-seekers who would escape the rigors of less favored localities. The air is exceedingly dry and the temperature is mild and equable. Socorro's public water supply comes

from warm springs that issue from Socorro mountain three miles away. The water is famed for its purity and has always been an attraction to visitors and residents.

The ground immediately adjacent to the School of Mines includes irrigable land, plateaus and mountains, all affording an excellent field for practice in surveying, the laying out of railroads and irrigating canals, topography, mine engineering and geology, so that students can be prepared at the very door of the school in those branches which usually require tedious excursions from many schools.

The New Mexico State School of Mines enjoys the natural advantage of being located in the midst of a region peculiarly rich in minerals of nearly all kinds, and is within easy reach of the most varied geological conditions, all of which are within a radius of thirty or forty miles of Socorro. The industrial processes connected with mining and metallurgy may be seen admirably illustrated at Mogollon, Kelly, White Oaks, San Pedro, Hillsboro, Lordsburg, Fierro, Silver City, Pinos Altos, Santa Rita, Burro mountains, Hurley, El Paso, Los Cerrillos, Dawson, Gallup, Carthage, and elsewhere within easy reach of the School. These illustrate the most modern methods of mining, milling, ore-dressing, concentrating, lixivation, cyaniding, and other metallurgical processes.

A number of mines of various kinds, smelters, irrigation systems, and other engineering works are accessible to the School. Within a few hours ride by rail are many important mining camps. The longer excursions bring the student to some of the most famous mines in southwestern United States. Some of the oldest worked lodes in America are in this region. Gold and turquoise were first noted by the *conquistadores* in 1540-2 by the celebrated expedition of Francisco Vasquez de Coronado, when in search of the Gran Quivera, one of the seven cities of Cibola. The first modern discovery of gold west of the Mississippi was made in New Mexico at the base of the Ortiz mountains, in Santa Fe county, in the year 1828. The first copper mined west of the Mississippi river was at Santa Rita in Grant county, in 1800. The metal from these copper mines was transported on the backs of burros to Mexico City and thence sent to the royal mint of

Spain to be made into coin. The Chino Copper Company now operates these celebrated mines. Among the great wonders of the West are the ancient turquoise workings at Mount Chalchihuitl, near Los Cerrillos. An ancient lode mine, known as Mina del Tierra, is situated near the ancient turquoise workings.

The history of modern mining schools shows that each becomes most celebrated along the line for which its locality is best known on account of its natural surroundings. Few institutions of learning are more dependent for success upon what may be called the accident of geographical location. It may be truthfully said that few mining schools are more fortunately situated so far as natural environment is concerned than that of New Mexico.

BUILDINGS AND GROUNDS

The Campus

The State School of Mines campus contains 32 acres of nearly level ground on the outskirts of the city of Socorro.

Main Building

The main building consists of three stories and a good basement. It is T-shaped, 135 feet long by 100 feet deep, the central rear wing being 54x32 feet. It is constructed in a very substantial manner of a beautiful gray granite in broken ashler and is trimmed with Arizona red sandstone.

The building is handsomely finished throughout. It is well ventilated, steam-heated, piped for water and gas, and wired for electricity for illumination and for experimental purposes.

As now arranged the main floor of this building contains the president's office, the mineralogical museum, the qualitative chemical laboratory and instructor's office. The basement contains two lecture rooms, the physical laboratory, and instructor's private mineralogical laboratory, the quantitative chemical laboratory, the electro-chemical laboratory, an instructor's private chemical laboratory, the chemical supply rooms, a photographic dark room, the hot water heating plant, and the lavatory. A lecture room, now occupied by the department of mathematics, is located on the second floor. The main library occupies the third floor.

Mining Engineering and Metallurgy Building

The engineering building is north of the main building and is constructed in the form of a Greek cross, sixty by one hundred twenty feet, twenty-four feet high. This structure is built of steel and concrete; the roof being concrete, the sash steel and the doors three-ply tin. The roof trusses are of steel monitor type,

carried on steel columns. The monitor is about ten feet wide and has a three-foot top-hung steel sash along both sides. This sash serves to ventilate the building, being operated from the floor by an endless chain pulley and worm gear. The arrangement of the windows and sash is such that the most remote corner is thoroughly illuminated.

This structure is employed at present to house the Mining and Metallurgy as well as the Civil Engineering department. The central part of the building is used for an Assay Laboratory, Ore Dressing Plant and Experimental Flotation Plant. The north wing of the structure is used for lecture rooms and office of the Mining and Metallurgy Department. The Civil Engineering Department occupies the south wing of the building.

Power Plant

The power plant building is constructed of reinforced concrete. The building is 34 feet long, 24 feet wide and 18 feet high. It is well lighted by 14 windows, each 4x6 feet, having heavy reinforced glass. The structure is absolutely fire-proof. The building is one of the most attractive structures on the grounds.

Dormitory

The School of Mines has an excellent dormitory. The building is heated with steam and lighted with electricity. There is a dining room and a kitchen in connection, also a bath room on each of the two floors and a shower bath in the basement. On the main floor is located the boys' club room.

LABORATORIES AND EQUIPMENT

Chemical Laboratories

The chemical laboratories as now arranged occupy the entire south wing of the main building, while the store room, private laboratory, and chemical lecture room are located in the central section of the same building. Elements of chemistry and qualitative analysis are taught in the large laboratory on the main floor. The room, which is exceptionally well lighted and ventilated, is equipped with large hoods, a balance room, and twenty-four desks, each of which is supplied with gas, water, and electric light.

The basement laboratory is fitted with large windows, glass partitions, and modern desks. The east half of it is used for quantitative analysis and wet assaying. There are large hoods in each end, which are supplied with hot plates and drying ovens, while each desk is equipped with an Alberine stone sink, water, gas, and electric lights.

In the west half of the basement there are the instructor's laboratory, electro-chemical laboratory, and balance room. The latter is fully equipped with the best analytical balances supported upon a solid concrete table, which is entirely free from vibration. The electro-chemical laboratory is supplied with current from a modern storage battery plant, consisting of a motor-generator, storage cells, and a switch-board so arranged that each student may obtain any current he desires for analytical or other electro-chemical experiments. There is also a supply of alternating current from the city circuit which may be used for light and for the small electric furnaces, in case of an accident to the School of Mines plant.

The laboratory is very completely equipped not only with all apparatus, chemicals, and supplies needed for the various courses, but the stock includes a large amount of pure chemicals and special apparatus, including standardized burettes, flasks,

and weights which are used for the most accurate rock analysis and research work.

All apparatus is loaned to the students. Chemicals and supplies are furnished at cost.

Assay Laboratory

The assay laboratory occupies the main floor of the metallurgy building. The furnaces are all new and include muffle gasoline blow-pipe furnaces of different types and large muffle coal and coke furnaces. This department is conveniently arranged with shelving, drawers and boxing for fluxes, and other assaying materials and supplies.

A weighing room containing a number of Becker's balances is conveniently located between the furnace-room and the lecture-room. In the grinding room there are various types of laboratory machines for carrying on experimental work.

Physical Laboratory

The physical laboratory occupies the east side of the north basement of the main building and contains the usual apparatus for illustrating the facts and laws of physics. In addition there is the apparatus necessary to perform the quantitative experiments outlined in Courses 201, 202 and 203 in the Department of Physics.

Petrographical Laboratory

For the microscopic study of rocks the school has a good collection of thin sections of various igneous, sedimentary, and metamorphic rocks, accompanied by hand specimens, giving the student an opportunity to study both the microscopic and megascopic characteristics. The laboratory is equipped with standard up-to-date microscopes, with all accessories, and a Sauveur and Boylston polishing machine for making thin sections and preparing polished surfaces of opaque minerals and mineral aggregates.

Mineralogical Laboratory

The School is provided with an abundant supply of ores and minerals for blow-pipe determinations and for the study of minerals by their physical characteristics. Several collections designed for this work have been recently secured. The laboratory is equipped with the necessary apparatus to carry on the work in an efficient manner.

Mineralogical Museum

The mineralogical museum, with instructor's office, occupies the north wing of the first floor of the main building. The School of Mines owns an excellent collection of minerals, ores, and rocks. The mineral specimens from some of the mining districts are segregated, thereby giving the student the best possible opportunity of studying the minerals of these districts without having actually visited them. New specimens are being added from time to time.

Electrical Equipment

The equipment of the power plant consists of two semi-Diesel Fairbanks-Morse Company engines. The smaller of the two engines delivers about 15 horsepower at full load, and is belted to an air compressor and also to a direct current dynamo. The compressor is used to store air in two cylindrical reservoirs at a pressure of 120 pounds per square inch for starting the larger engine. The fuel oil used by these engines may be any crude heavy oil or distillate. The larger engine is controlled by an inertia governor on the main shaft and varies the supply of oil according to the speed. The cylinder is lubricated by forced feed. The larger of these two engines is intended to furnish most of the power on the campus. It is of the vertical type and runs with very little vibration. The top of the cylinder is about eight feet above the base of the engine. The fly-wheel is about seven feet in diameter and weighs nearly five tons. It is mounted between the vertical engine and the alternating current generator which furnishes power to the various buildings. The alternating current generator gives a 3-phase current, so that either 3-phase or single phase motors may be used in the various buildings. The larger engine and alternator will deliver 37.5 kilowatts at 440 volts when run at 257 revolutions per minute. The current is about 47 amperes per phase at full speed. The field coils of the alternator are excited by means of a generator, which is run from the main shaft of the larger engine. The generator can deliver 40 amperes and 125 volts when run at 1250 revolutions per minute. The direct current dynamo connected with the smaller engine will deliver 60 amperes at 125 volts when run at 1250 revolutions per minute. The frequency of the alternating current at the rated speed of the larger engine is 60 cycles per second.

There are two switchboards, one for the alternating current power circuits and one for the direct current power circuits. The

former was designed and constructed by the Westinghouse Electric Company, and the latter by the General Electric Company. The former contains three panels; an exciter panel, a generator panel, and a feeder panel. There are thirteen ammeters and volt-meters mounted on these panels, together with a three-phase watt meter. Oil switches are used in the main alternating current circuit and in the various feeding lines, which run to the 3-phase and single phase meters. It is possible to see at a glance the amount of current that is being used on these branches and the total amount of power that is being used on all the motors.

The voltage of each phase can also be measured. Current transformers are used in connection with the 3-phase watt meter. There are the usual arrangements for detecting grounds. The switch board also provides for the installation of an additional similar power unit to run in synchronism with the present unit.

EXPERIMENTAL FLOTATION PLANT

The Chino Copper Company, of Hurley, New Mexico, of which Mr. John M. Sully is manager, has generously donated to the New Mexico School of Mines a complete two-ton experimental flotation plant consisting of one jaw crusher, one plunger feeder, one ball mill, one Wilfley table, two elevators, three Callow cells and three Janney flotation machines, together with the necessary shafting and drive pulleys.

The machinery was installed during the past year and is available for use in the metallurgical courses. This equipment will make it possible to carry on experiments on sufficiently large portions of ore to make the student's work of great practical value to him.

This experimental plant is housed in the main room of the Mining and Metallurgical Building.

Engineering Instruments

The school has purchased and has on hand for student use sufficient equipment to make such surveys as are required in ordinary practice of engineering. This naturally embraces a complete assortment of transits, levels, plane tables, planimeters, as well as rods, tapes and other accessories. This collection is constantly growing and equipment that cannot be repaired and used is discarded and new equipment added.

Draughting Room

A spacious, well-lighted draughting-room is provided in the mechanical building. Opening off from it are the instructor's office, supply-room, blue-print room, with large printing frame, developing-vat, and drying rack.

A drawing table is furnished each student. There are private spaces for his materials and instruments. An Ingersoll-Rand drill and other pieces of machinery are used as models.

Libraries

The libraries of the New Mexico School of Mines consist of a general library and department libraries.

In the main library are the **encyclopedias**, dictionaries, journals, magazines, proceedings of the learned societies, periodical issues of other colleges, reports of federal, state and foreign surveys, official maps, plats, and atlases.

The following periodicals and publications are received by the School:

Engineering and Mining Journal.

Mining and Scientific Press.

Power.

Engineering News Record.

Chemical and Metallurgical Journal.

Journal of the American Chemical Society.

Journal of Industrial and Engineering Chemistry.

Electrical World.

Chemical Abstracts.

Economic Geology.

Journal of Geology.

Transactions of the American Institute of Mining Engineers.

All the U. S. Geological Survey Publications.

U. S. Bureau of Mines Publication.

Canadian Geological Survey Publications.

Various daily and weekly papers.

Libraries are located in the several departments of the School. These are essentially working libraries. They consist of carefully chosen treatises, text-books, monographs, and special contributions pertaining to the respective divisions.

Powell Library.—The School has come into possession of the private library of the late Major John W. Powell of Washington, D. C., who for many years was director of the United States

Geological Survey. The collection consists of works on mining, geology, philosophy and many rare monographs of great practical value. Especially well represented is the literature relating to the Rocky Mountain region and the great southwest. It was in these fields that Major Powell did most of his work which has had such an important influence on the development of the mining industry. It therefore seems particularly fitting that the library of this famous man, who has been so long identified with this western country, should find a permanent home in New Mexico.

Socorro Mountain Mines

The silver mines at the base of Socorro Mountain, only about two miles west of the School campus, afford excellent opportunity for the practice of mine-surveying and for a study of some features of practical mining. The ore-bodies with associated geological structures and many other features will interest the student of mining and geological engineering.

Purpose

The ideal to which the New Mexico School of Mines tenaciously holds is the practical directing of young men to take active part in the development of the mineral wealth of the world.

The school is a state institution, established primarily to promote the development of the mineral resources of New Mexico and to provide facilities for the young men of the state to secure a practical education in all departments of mining. The institution's field of usefulness has steadily grown broader, through its graduates, not only in New Mexico, but also in other parts of the southwest, in the development of the mining industries of this great region. Moreover, a considerable number of students from other parts of the country who desired to avail themselves of the peculiar advantages of this region have come to the School of Mines for the training they needed.

During the entire period of his training the fact is impressed upon the mind of the student that mining is a business capable of being put on as secure a foundation as any other; that from beginning to end it is akin to all other great business undertakings.

Advantages

Several features contribute to the success of this institution as a school of mines:

The unique natural surroundings of the School already described create an invigorating mining atmosphere which is entirely wanting in institutions remote from the mines and mountains.

In the training offered by the School there is noteworthy concentration of effort. There are many advantages in specialization along few lines. In contrast with the many diversions that necessarily exist in those technical institutions of learning where all practical branches are equally represented, singleness of purpose is a leading feature of the New Mexico State School of Mines. The concentration of energy growing out of the special method of instruction happily adapts the student so that he gets the most out of his labors.

The student is expected as an integral part of his course to visit and critically inspect, under the direct supervision of his instructors, various plants and works and to make intelligent reports. Being obliged from the start to make the most of the exceptional opportunities presented, he quickly falls into the spirit of his present and future work and at once necessarily acquires for his chosen profession a sympathy that is seldom attained, except after school days are over and after long and strenuous effort.

Being within short distances of mines and smelters, the student has the opportunity of finding regular employment during his vacation and of acquiring desirable experience in practical work.

The field for scientific research in New Mexico is unrivalled and the opportunities here offered are not neglected in the plan and scope of instruction. New Mexico is perhaps less known geologically than any other section of the United States. A little study of the plateau region of the northwestern portion of the state has been made by the United States Geological Survey, but only in a general way. No attempt has ever been made under government auspices to investigate closely the geological structure of New Mexico mountains such as has been carried out in the other Rocky Mountain states, nor to study the conditions of New Mexico mineral deposits as has been done in Colorado by Emmons, in Nevada by Curtis, in California by Becker, and in other states by other distinguished investigators.

Much of the advanced professional work of the School is of an original nature to the end that the graduates may be skilled, theoretically and practically, in the very problems which they as professional men will be called upon to solve. This work is carried on by the advanced students under the direction of the professors and involves the collection of notes, sketches, maps, and specimens, and the results of directed observation in all matters relating to the sciences and arts embraced in the courses of study. The subjects for such researches in geology and mining in the reduction of the ores of lead, silver, gold, copper, and zinc are so numerous that it is impossible to do more here than to mention the fact that the conditions of climate, drainage, water-supply, and geological structure in New Mexico differ greatly from the conditions existing in other parts of the Rocky Mountains, thus giving rise to new problems in practice. These problems are not by any means all that deserve attention. The investigations of the ores of iron, manganese, aluminum, cobalt, nickel, tin, quicksilver, vanadium, and uranium, together with the beds of coal, salt, alum, building stones, mineral-paints, cement-rock, marls, etc., are directly in line with the advanced laboratory work of the School. Work of this character on the part of the students is encouraged in every possible way.

ADMINISTRATION

The general management of the New Mexico State School of Mines is vested in a Board of Regents consisting of five members appointed by the Governor of the State with the concurrence of the Senate for a term of four years. The Board of Regents elects a president from its members and also a secretary and treasurer. The appointment of a president and other members of the faculty and teaching staff is made by them.

By an Act of the Legislature, the maintenance of a preparatory department is required. The New Mexico State School of Mines, therefore, is composed of the College and the Academy.

THE COLLEGE OF ENGINEERING

ADMISSION

Applicants for admission to the College should arrange to be present the first day of the school year. In 1920 the College opens September 7th and students will register on that day.

Admission by Certificate

Graduates of approved high schools of this and other states or of other schools offering equivalent training will be admitted to the regular four-year courses without examination, provided their certificate of graduation shows that they have included in their preparatory work at least one unit of algebra, one unit of plane geometry, one-half unit of solid geometry, and one unit of either elementary physics, chemistry or general science.

If applicant is deficient in one or two of the subjects specified above he may be admitted conditionally. The Academy offers opportunity for the removal of such conditions and all students thus admitted will be expected to remove their conditions during their Freshman year.

Admission by Examination

Candidates for admission who cannot show a certificate of graduation from an approved preparatory school will be required to stand examination in one unit of algebra, one unit of plane geometry, one-half unit of solid geometry, one unit in either elementary physics, chemistry, or general science, and eight and one-half units of elective subjects. The results of these examinations will be presented to the faculty and with their consent the applicant may enter the school. All students admitted by this method will be expected during their first semester to show that they are capable of pursuing with success work of college character.

Admission on Advanced Standing

Students desiring to enter this college on credits from other institutions should present a copy of their credits, together with letter of honorable dismissal, to the President of the College.

This College is willing to give credit for work done in other recognized institutions in so far as it applies upon our courses of study. The amount of credit given for any subject is determined by the department in which similar work is offered.

Soldier Specials

To men not regularly or formerly prepared for college and who, as a result of their war experiences, aspire to advanced training, there is offered the opportunity of entrance into the college work without examination or certificate. The subsequent advancement of this class of students to regular standing is a matter of faculty decision. To those who do not desire or obtain regular standing there will be furnished a certificate indicating the work accomplished.

Mature Students

Students who are twenty-one years of age or older, and particularly those who have had considerable practical experience along some technical line, will be permitted to enter the Freshman class. After entrance the student must acquire credit in elementary physics, elementary algebra, plane and solid geometry, and a good working knowledge of English.

Registration

No student will be allowed to register for any subject until the pre-requisites are credited to him on the school records. Therefore the student is advised not to delay either in making up any deficiencies which may exist or in obtaining the credits which may be due him for work done elsewhere.

DEGREES

This institution confers two classes of degrees: First, the Bachelor of Science degree at the completion of one of the prescribed four-year courses; and, second, the degree of Engineer of Mines, Metallurgical Engineer, Geological Engineer, or Civil Engineer upon compliance with certain additional requirements.

The degree of Bachelor of Science in Mining Engineering, Metallurgical Engineering, Geological Engineering, Civil Engineering or General Science is conferred upon those who, as students of the institution, have completed the corresponding prescribed courses of any one of the several curricula. This degree is also conferred upon those who, as students of this institution,

have completed the courses which represent one full year's work in any of the several curricula and have given satisfactory evidence of having previously completed the other courses of that curriculum. A candidate for the Bachelor's degree must announce his candidacy at the beginning of the school year at whose termination he expects to receive the degree. This announcement must be in writing and must specify both the curriculum and the degree sought.

The degree of Engineer of Mines, Metallurgical Engineer, Geological Engineer, or Civil Engineer, will be conferred upon a graduate of this school who has completed the corresponding undergraduate course; who has done at least two years of successful professional work along that line subsequent to receiving the Bachelor's degree, during one of which he has held a position of responsibility; and who has presented an original and acceptable thesis. The appropriate Engineer's degree will also be granted to a graduate of this school who has fulfilled the above scholastic and thesis requirements and who has had at least five years of professional experience along technical lines during one of which he has occupied a position of responsibility.

A candidate for the Engineer's degree should make application for the same on or before January first of the school year in which the degree is to be granted. He should at the same time submit the subject of his thesis, which must be approved by the Faculty. Each thesis must be typewritten on paper eight and one-half by eleven inches, and must be submitted not later than March first. If it is found to be satisfactory the advanced degree will be granted on Commencement day at the end of the school year. A corrected copy of the thesis must be delivered to the President at least two weeks prior to the granting of the degree. It is expected that the thesis in each case shall be prepared with care and shall exhibit sufficient evidence of independent investigation to warrant its publication at the discretion of the Faculty. Work done at other colleges for a degree may be accepted so far as it corresponds to the work done here, but in each case the Faculty reserves the right to decide whether the previous work has been satisfactory.

All degrees are conferred by the Board of Regents upon the recommendation of the Faculty.

Curricula

- I. Mining Engineering.
- II. Metallurgical Engineering.
- III. Geological Engineering.
- IV. Civil Engineering.
- V. General Science.

In the following outlined statement of curricula the number of periods per week required in the class-room and in the field or in the laboratory are given separately. The number of periods required in the field or in the laboratory represents *average* time, however, inasmuch as it is frequently advantageous, especially for field work, to concentrate into one week an amount of work equal to that which would require two or more weeks if performed in separate installments.

UNIFORM CURRICULUM FOR THE FIRST TWO YEARS OF COURSES I, II, III AND IV.

The curriculum for the first and second years of courses I, II, III and IV, offered at the School of Mines is the same in all respects. This arrangement is of advantage to the student, as it gives him until the beginning of the third year to determine for which of the four courses he is best fitted by inclination or aptitude.

Mathematics, physics, and chemistry are fundamental subjects for the successful engineer. For that reason the first two years of all the engineering courses are devoted to a thorough grounding in those three subjects, as will be seen in the tabular statement below. Specialization does not begin until afterwards.

Excellent facilities are offered for the acquisition of a thorough knowledge of these subjects so necessary to successful engineering work both during the remainder of the course and during a professional career.

UNIFORM CURRICULUM. FRESHMAN YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
First Semester			
101	Algebra	4	
103	Trigonometry	4	
301	General Chemistry	4	6
401	Mechanical Drawing		6
801	English	3	
805	Spanish	3	
Second Semester			
104	Analytic Geometry	5	
302	General Chemistry	3	
304	Qualitative Analysis	2	9
402	Mechanical Drawing		3
406	General Surveying	2	4
802	English	3	
806	Spanish	3	

**UNIFORM CURRICULUM.
SOPHOMORE YEAR**

Course Number	Courses	Periods a week	
		Class	Lab'y
First Semester			
105	Calculus	4	
201	Physics	3	3
305	Quantitative Analysis		6
407	Mine Surveying and Mapping.....	1	4
501	General Geology	3	
509	Mineralogy	3	3
803	English	2	
807	Spanish	2	
Second Semester			
106	Calculus	4	
202	Physics	3	3
306	Quantitative Analysis		6
408	Topographic Surveying	2	4
502	General Geology	2	1
510	Mineralogy	3	3
804	English	2	
808	Spanish	2	

I. MINING ENGINEERING

As one of the chief purposes of the School is to prepare men to become designers of mining plants and supervisors of mining operations, the strictly business careers of the profession are kept constantly before the student. Valuing property, properly reporting propositions submitted for investment, calculating the factors in the economical operation of a plant and suggesting the best methods of developing a property, are considerations which receive careful treatment and are given prominence during the latter part of the curriculum.

Especially are the similarities and departures between the operations and requirements of metal-mining and coal-mining brought out. Placer and hydraulic mining and dredging, and the recent adaptation of the steam shovel and stripping methods to western metal mines are treated at considerable length.

Another important feature which is continually being more and more considered in mining operations is the geology of mineral deposits, and this subject receives detailed consideration.

JUNIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
First Semester			
203	Direct and Alternating Currents	5	3
397	Advanced Quantitative Analysis		4
403	Machine Drawing		3
405	Descriptive Geometry	2	3
503	Economic Geology	2	
511	Petrology	1	3
601	Principles of Mining	2	
701	Fire Assaying	2	
703	Principles of Metallurgy	4	
Second Semester			
410	Railroad Surveying	2	3
412	Mechanics	5	
504	Economic Geology	3	
512	Petrology	1	3
602	Principles of Mining	2	
702	Fire Assaying		8
704	Metallurgy of Iron and Steel.....	5	

SENIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
419	Masonry Construction	2	
423	Strength of Materials	3	
425	Hydraulics	2	
507	Field Geology	1	8
603	Ore Dressing	3	3
605	Mine Examination	1	4
607	Mine Administration and Accounts...	2	
705	Metallurgy of Non-Ferrous Metals...	4	
	Second Semester		
404	Machine Design	1	3
420	Air Compression and Pumping.....	2	
422	Engines and Boilers	2	3
506	Ore Deposits	3	
604	Ore Dressing	2	
608	Design of Mine Plant		3
706	Metallurgy of Non-Ferrous Metals....	5	
708	Metallurgical Laboratory	1	8
610	Mining Law (Elective)	2	

II. METALLURGICAL ENGINEERING

The aim of this four years' course is to train the student for a professional career in any branch of metallurgical work. Attention is given during the first two years to such fundamental subjects as mathematics, chemistry, physics, geology, mineralogy, and preliminary courses in engineering. Instruction in metallurgy proper begins in the third year, both lectures and laboratory experiments being employed for the purpose. Chemistry and geology are provided for, also. The work of the fourth year is along the line of advanced courses in metallurgy; especial attention being given to laboratory experiments, high temperature conditions of metallurgy, training in execution and interpretation of results. Such higher branches of engineering, chemistry, and courses of importance in mining engineering claim a considerable share of attention.

The course has been chosen with special reference to giving the student in metallurgical engineering a general knowledge of modern metallurgy as a whole, and a special knowledge of the metallurgy of each of the more important metals.

Freshman and Sophomore years. See pages 32 and 33.

JUNIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
First Semester			
203	Direct and Alternating Currents.....	5	3
309	Metallurgical Analysis		8
403	Machine Drawing		3
405	Descriptive Geometry	2	3
503	Economic Geology	2	
601	Principles of Mining	2	
701	Fire Assaying	2	
703	Principles of Metallurgy	4	
Second Semester			
206	Thermodynamics	2	
308	Electro-Analysis		6
412	Mechanics	5	
504	Economic Geology	3	
512	Petrology	2	3
602	Principles of Mining	2	
702	Fire Assaying		8
704	Metallurgy of Iron and Steel	5	

SENIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
First Semester			
423	Strength of Materials.....	3	
425	Hydraulics	2	
603	Ore Dressing	3	3
607	Mine Administration and Accounts....	2	
705	Metallurgy of the Non-Ferrous Metals	4	
709	Metallurgical Calculations	1	
711	Metallurgical Plant Design.....	1	6
713	Metallography	2	3
Second Semester			
310	Physical and Theoretical Chemistry...	2	
404	Machine Design	1	3
420	Air Compression and Pumping.....	2	
506	Ore Deposits	3	
706	Metallurgy of Non-Ferrous Metals....	5	
708	Metallurgical Laboratory	1	8
712	Metallurgical Plant Design.....		6
714	Electro-Metallurgy	2	
610	Mining Law (Elective).....	2	

III. GEOLOGICAL ENGINEERING

This course is intended primarily to give the training necessary in order to follow successfully any of the usual branches of geological work. It also prepares the student to examine and report correctly on prospects and mining properties, and to direct underground prospecting and development work. Attention is given to the geology of oil and gas and the examination of possible oil-bearing areas.

In the first two years a thorough training is given in such fundamental subjects as mathematics, physics, chemistry, surveying, and English. Geology and mineralogy are included in the second year's work and are followed by petrology and economic geology in the third year and field geology, ore deposits, paleontology, and oil and gas geology in the fourth year. Accompanying these subjects in the last two years are courses in assaying, advanced electricity, mechanics, hydraulics, metallurgy, ore-dressing, principles of mining, and mine examination.

JUNIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
203	Direct and Alternating Currents.....	5	3
405	Descriptive Geometry	2	3
503	Economic Geology	3	
515	Petrology	1	6
601	Principles of Mining	2	
701	Fire Assaying	2	
703	Principles of Metallurgy	4	
	Second Semester		
412	Mechanics	5	
504	Economic Geology	3	
516	Petrology	2	6
602	Principles of Mining	2	
702	Fire Assaying		8
704	Metallurgy of Iron and Steel.....	5	

SENIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
First Semester			
423	Strength of Materials	3	
425	Hydraulics	2	
505	Oil and Gas Geology	2	
507	Field Geology	1	8
513	Paleontology	2	3
603	Ore Dressing	3	3
605	Mine Examination	1	4
705	Metallurgy of the Non-Ferrous Metals	4	
Second Semester			
310	Physical and Theoretical Chemistry..	2	
508	Applied Geology	2	8
514	Ore Deposits	5	
604	Ore Dressing	2	
608	Design of Mine Plant		3
706	Metallurgy of the Non-Ferrous Metals	5	
610	Mining Law (Elective)	2	

IV. CIVIL ENGINEERING

This department provides a course of study in the theory and application of the principles of civil engineering. The first two years of work are the same as in the other engineering courses, including practical work in drafting room and field, as well as instruction in the fundamental principles of mathematics and physics. In the third year the studies relate more directly to civil engineering. Technical courses cover the principles of structural and machine design, power and power transmission, and other fundamental engineering processes. In the drafting room the student applies those principles to the design of machines, and the bridge and roof trusses. Sufficient field work is given to make the student thoroughly familiar with surveying instruments, and their use in road, mine, and railroad surveys. The proper care and adjustment of surveying and engineering instruments are made prominent in the training of the civil engineer.

Freshman and Sophomore years. See pages 32 and 33.

JUNIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
203	Direct and Alternating Currents.....	5	3
403	Machine Drawing		3
405	Descriptive Geometry	2	3
413	Roads and Pavements	2	3
415	Theory of Structure	3	3
417	Materials of Construction	5	
	Second Semester		
206	Thermo-Dynamics	2	
410	Railroad Surveying	2	3
412	Mechanics	5	
414	Railroad Engineering	3	
416	Cement Testing		6
704	Metallurgy of Iron and Steel	5	

SENIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
409	Irrigation and Drainage	5	3
419	Masonry Construction	2	
421	Contracts and Specifications	2	
423	Strength of Materials	3	
425	Hydraulics	2	
427	Hydraulic Engineering		3
429	Cost Keeping and Management.....	1	
431	Reinforced Concrete	2	3
	Second Semester		
420	Air Compression and Pumping.....	3	
422	Engines and Boilers	3	3
424	Bridge Design	2	3
426	Structural Design	3	3
428	Municipal and Sanitary Engineering..	2	3
430	Water Supply Engineering	3	3
610	Mining Laws (Elective)	2	

V. GENERAL SCIENCE

This course is not designed to prepare students for any special branch of engineering, but rather to provide a broad general training along scientific lines. A total of 188 credit hours, approximately one-third of which are elective, are required for graduation. The student is thus given an opportunity to specialize in some branch, according to his inclination.

Freshman year is the same as for Courses I, II, III and IV.

SOPHOMORE YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
201	General Physics	3	3
305	Quantitative Analysis		6
407	Mine Surveying and Mapping	1	4
509	Mineralogy	3	3
803	English	2	
807	Spanish	2	
	One of the following subjects must be elected:		
501	General Geology	3	
105	Calculus	4	
	Second Semester		
202	General Physics	3	3
306	Quantitative Analysis		6
408	Topographic Surveying	3	4
510	Mineralogy	3	3
804	English	2	
808	Spanish	2	
	One of the following subjects must be elected:		
502	General Geology	2	1
106	Calculus	4	

JUNIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
203	Direct and Alternating Currents	5	3
403	Machine Drawing		3
601	Principles of Mining	2	
701	Fire Assaying	2	
703	Principles of Metallurgy	4	
	A minimum of six (6) credits to be selected from the following:		
307	Advanced Chemistry		8
405	Descriptive Geometry	2	3
413	Roads and Pavements	2	3
415	Theory of Structures	3	3
417	Materials of Construction	5	
503	Economic Geology	2	
511	Petrology	1	3
809	Spanish	3	
	Second Semester		
308	Electro-Analysis		6
410	Railroad Surveying	2	3
602	Principles of Mining	2	
702	Fire Assaying		8
704	Metallurgy of Iron and Steel	5	
	A minimum of six (6) credits to be selected from the following:		
412	Mechanics	5	
414	Railway Engineering	3	
416	Cement Testing		6
504	Economic Geology	3	
512	Petrology	1	3
810	Spanish	3	

SENIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
	The work is elective. Elections may be made from the following:		
409	Irrigation and Drainage	5	3
419	Masonry Construction	2	
421	Contracts and Specifications	2	
423	Strength of Materials	3	
425	Hydraulics	2	
431	Reinforced Concrete	2	3
505	Oil Geology	2	
507	Field Geology	1	8
513	Paleontology	2	3
603	Ore Dressing	3	3
605	Mine Examination	1	4
607	Mine Administration and Accounts..	2	
705	Metallurgy of the Non-Ferrous Metals	4	
709	Metallurgical Calculations	1	
711	Metallurgical Plant Design	1	6
713	Metallography	2	3
	Second Semester		
	The work is elective, and elections may be made from the following:		
301	Physical and Theoretical Chemistry..	2	
428	Municipal and Sanitary Engineering..	2	3
430	Water Supply Engineering	3	3
508	Applied Geology	2	8
514	Ore Deposits	5	
604	Ore Dressing	2	
608	Design of Mine Plant.....		3
706	Metallurgy of Non-Ferrous Metals ...	5	
708	Metallurgical Laboratory	1	8
714	Electro-Metallurgy	2	
610	Mining Law	2	

A student must receive credit in both semesters of a two-semester subject in order that the credit be counted for graduation.

DEPARTMENT OF MATHEMATICS

PROFESSOR REECE.

The following is a brief description of the several courses, regularly offered, in the Department of Mathematics:

101. College Algebra

Required in I, II, III, IV and V.

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, four periods a week.

Review of fundamental principles; variables and functions; theory of exponents, including logarithms; graphs; equalities, inequalities; ratio, proportion and variation; mathematical induction; binomial theorem; progressions; complex numbers; undetermined coefficients; partial fractions; permutations and combinations; probabilities.

103. Plane and Spherical Trigonometry.

Required in I, II, III, IV and V.

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, four periods a week.

The trigonometric functions are defined as ratios; proofs of the principal formulas used in the solution of both the plane and spherical triangles; trigonometric transformations; circular measure of angles; solution of trigonometric equations; inverse trigonometric functions; solution of right and oblique triangles, plane and spherical, with and without the use of logarithms.

104. Analytic Geometry.

Required in I, II, III, IV and V.

Prerequisites: Courses 101 and 103.

Time: Freshman year, second semester.

Lectures, five periods a week.

Systems of co-ordinates; graphical representation of functions; transformation of co-ordinates; graphs of trigonometric and

transcendental functions; the straight line; circle, parabola; ellipse; hyperbola; empirical equations; space co-ordinates; space curves; surfaces; limits; introduction to the calculus.

105. Calculus.

Required in I, II, III and IV.

Prerequisites: Course 104.

Time: Sophomore year, first semester.

Lectures, four periods a week.

Limits; derivatives; geometrical and physical interpretations of the derivative; successive differentiation; differentiation of transcendental functions; elementary applications to physics and geometry; maxima and minima of functions; differentials; rates; integration, with simple applications to problems in physics and geometry.

106. Calculus.

Required in I, II, III and IV.

Prerequisites: Course 105.

Time: Sophomore year, second semester.

Lectures, four periods a week.

This is a continuation of Course 105 and treats of curvature; asymptotes; partial derivatives; formal integration; use of integral tables; integration as a summation process; successive integration; series; application of definite integrals, including double and triple integrals, to geometry and mechanics.

DEPARTMENT OF PHYSICS

PROFESSOR REECE.

The following is a detailed description of the several courses in the Department of Physics:

201. Physics.

Required in I, II, III, IV and V.

Prerequisites: Courses 101 and 103.

Time: Sophomore year, first semester.

Lectures, three periods a week.

Laboratory, three periods a week.

The subject includes the mechanics of solids, liquids and gases; heat, with introduction to thermodynamics.

A laboratory course accompanies and supplements the lectures. It is quantitative in character, and involves measurements and determinations of the principal quantities in physics. The following experiments are performed: Equilibrium of forces; composition of forces; accelerated motion; relation of force to mass and acceleration; moments; theory of weighing; impact of elastic and inelastic bodies; Young's modulus; co-efficient of rigidity; simple harmonic motion; measurement of gravitation constant; moment of inertia; center of gravity; co-efficient of expansion; calorimetry; Boyle's law; Archimedes' principle; and others if time permits.

202. Physics.

Required in I, II, III, IV and V.

Prerequisites: Course 201.

Time: Sophomore year, second semester.

Lectures, three periods a week.

Laboratory, three periods a week.

This course is a continuation of Course 201, and includes the subjects of electricity and magnetism; light; sound. Particular stress is placed upon the magnetic, heating and chemical effects of the electric current; on the distribution of current and potential, in both series and parallel circuits; upon the laws of reflection and interference of waves, and the theory of optical instruments.

Parallel with the lecture course is the laboratory course. The experiments include: determination of pitch and composition of sounds; length of sound waves; velocity of sound; diffraction and interference of light; photometry; refraction; spectrum analysis; measurements of current; resistance; electromotive forces; capacities; inductances.

203. Direct and Alternating Currents.

Required in I, II, III, IV and V.

Prerequisites: Courses 106 and 202.

Time: Junior year, first semester.

Lectures, five periods a week.

Laboratory, three periods a week.

Discussions and laboratory work on electric circuits and resistance, magnetic circuits, electro-magnets, Ohm's law, measurement of resistance and power in electric circuits, direct current generators and motors; starters and controllers; storage batteries, the practical operation of generators and motors; inductance, capacity, reactance, impedance, power factor, alternators, induction motors, transformers, electric illumination, practical operation of machines.

204. Thermodynamics.

Prerequisites: Courses 106 and 201.

Time: Junior year, second semester.

Lectures, two periods a week.

Required in Courses II and IV.

Topics treated: mechanical theory of heat; work done and heat expended in expansion; cycles of perfect gases and vapors; heat engines; commercial results obtained and possibilities of development of steam, air, and gas engines; refrigerating machines; flow of steam; injectors; condensers.

DEPARTMENT OF CHEMISTRY

PROFESSOR ILLINSKI.

301. General Chemistry.

Required in I, II, III, IV and V.

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, four periods a week.

Laboratory, six periods a week.

This course is introductory to the engineering courses and is required of all students. The fundamental principles of the science are taught in connection with the descriptive chemistry of the more important non-metals. The lectures are designed to precede the work of the laboratory, in which the student is expected to illustrate and verify the facts and principles which have been discussed in the lectures. Careful manipulation, thoroughness in observation, accuracy in arriving at conclusions, and neatness in note-taking are required of each student.

No previous study of chemistry is required for admission to this course, but the laboratory instruction is so arranged that students who have already spent considerable time upon chemical work in the secondary school are permitted to conduct experiments of a somewhat advanced character, in which the knowledge they have already acquired is utilized.

302. General Chemistry.

Required in I, II, III, IV and V.

Prerequisites: Course 301.

Time: Freshman year, second semester.

Lectures, three periods a week.

Continuation of Course 301. Devoted to the chemistry of the metals, with particular attention being paid to the reactions employed in analytical chemistry, in metallurgy, and in geology. The knowledge of the laws and theories previously acquired is applied to practical examples as they arise.

304. Qualitative Analysis.

Required in I, II, III, IV and V.

Prerequisites: Course 301, accompanied by Course 302.

Time: Freshman year, second semester.

Lectures, two periods a week.

Laboratory, nine periods a week.

The lectures include a thorough grounding in the principles upon which are based the qualitative separations and the identification of the commoner elements. In the laboratory the student is given practical instruction in manipulation that he may best apply the knowledge gained in the lectures. He is gradually led through the more simple separations to the analysis of alloys, minerals, rocks, slags, and mattes. A neat, systematic notebook containing the method of separation used, the reasoning involved in its selection, the confirmatory tests, and all the equations involved, is an essential part of this course.

305. Quantitative Analysis.

Required in I, II, III, IV and V.

Prerequisites: Course 304.

Time: Sophomore year, first semester.

Laboratory, six periods a week.

A course embodying the general principles of quantitative analysis and introductory to those involving special quantitative methods. In the laboratory the following experiments are performed: The gravimetric determination of chlorine in a soluble chloride; water of crystallization in copper sulphate; iron and sulphur in ferrous sulphate; carbon dioxide; calcium and magnesium in dolomite; alumina in an alum; closing with a complete analysis (technical) of a clay.

306. Quantitative Analysis.

Required in I, II, III, IV and V.

Prerequisites: Course 305.

Time: Sophomore year, second semester.

Laboratory, six periods a week.

A thoroughly practical course, largely volumetric, in the determination of the important constituents of ores and metallurgical products. The methods taught are those in use in the large smelters of the West. The student works upon checked samples of widely varying composition until he becomes familiar with the various methods and can carry them out under all conditions with accuracy and rapidity.

Each student is required to analyze two or more ores for each of the following: Iron, copper, zinc, lead, phosphorus, calcium,

manganese, sulphur and arsenic. The essential parts of the course are speed tests, in which the students are required to report correct results on a number of copper, zinc and lead ores.

307. Advanced Quantitative Analysis.

Required in I.

Prerequisites: Course 306.

Time: Junior year, first semester.

Laboratory, four periods a week.

This is an extension of Course 306. The student is permitted to some choice in the work to be pursued. It may consist of methods of determination of Molybdenum, Tungsten, Uranium, Vanadium and others of the more important commercial alloy metals.

308. Electro-Analysis.

Required in II and V.

Prerequisites: Course 306.

Time: Junior year, second semester.

Laboratory, six periods a week.

This course will deal with the practical application of the electric current in determining some of the common metals, such as copper, silver, lead and zinc. After the student has become familiar with the methods used for determining each of these, he will use the current in separating mixtures of metals and as a rapid, accurate method of ore analysis.

309. Metallurgical Analysis.

Required in II.

Prerequisites: Course 306.

Time: Junior year, first semester.

Laboratory, eight periods a week.

In this course the student may select such of the following as are best suited to his needs: analysis of rocks and minerals, spieghels, crude and refined lead and copper bullion, spelter, iron and steel, alloys, cement, or the determination of some of the rare elements.

310. Physical and Theoretical Chemistry.

Required in II and III.

Prerequisites: Course 306.

Time: Senior year, second semester.

Lectures, two periods a week.

The elements of theoretical chemistry have already been stud-

ied in the course in general chemistry, qualitative and quantitative analysis. The subject is here pursued more exhaustively. The principal subjects considered are: The gas laws, atomic and molecular weights and the methods of determining them, forms and the phase rule, kinetic theory, thermo-chemistry, ionization, dissociation and balanced actions and electro-chemistry.

311. Industrial Inorganic Chemistry. (Special.)

Prerequisite: Course 302.

Time: Junior year.

Lectures, two periods a week.

The utilization of inorganic materials in manufacturing processes was taken up in an elementary way in connection with general chemistry. This special industrial course goes into the subject considerably more in detail. The manufacturing processes considered are mainly those of acids, alkalies, mineral dyes, mineral paints, explosives and matches.

The aim is to expound the dominant principles underlying each process rather than to present such an account of the details as will suffice for the student of any particular industry. In this manner, the student is prepared to study efficiently the literature of any branch in which he may afterwards become especially interested.

312. Organic Chemistry. (Special.)

Prerequisite: Course 302.

Time: Junior year.

Lectures, two periods a week.

Laboratory, six periods a week.

This course serves as an introduction to the study of the hydrocarbons of both the fatty and aromatic series, alcohols, phenols, aldehydes, organic acids, ethers, esters and carbohydrates. Their formation, relations and derivatives are discussed, and special attention is given to the explanation of familiar organic phenomena.

313. Oil Analysis. (Special.)

Apparatus has been installed by the School making it possible to make the more important determinations necessary in Oil

Analysis. These determinations include Flash Point, Burning Point, Cold Point, Viscosity, Specific Gravity, Calorific Value, Sulphur in the oil, and Fractionation.

The above tests are made by methods standard throughout the United States.

DEPARTMENT OF CIVIL ENGINEERING

PROFESSOR OCKERBLAD.

The courses in engineering described in the pages immediately following are designed to train the student in the theory and practice of those subjects which form the basis of professional practice. He is taught the construction, care and use of engineering instruments and the methods used in the solution of the usual problems of practice. The advanced courses give special attention to materials for roads, highways, buildings and general engineering construction, and the methods used in conventional design of engineering structures.

Opportunities are numerous for the study of irrigation and drainage engineering as the Rio Grande Project of the United States Reclamation Service of which the Elephant Butte dam is a part, is within ninety miles of Socorro.

401. Mechanical Drawing.

Required in I, II, III, IV and V.

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Laboratory, six periods a week.

This course involves the use of instruments, geometric construction, representation of objects by orthographic and isometric projections. Special attention is given to lettering, shading and the principles of dimensioning.

402. Mechanical Drawing.

Required in I, II, III, IV and V.

Prerequisites: Course 401.

Time: Freshman year, second semester.

Laboratory, three periods a week.

A continuation of Course 401: Intersections and developments of planes and solids, isometric and perspective drawings. Shop drawings of machine parts from sketches and models.

403. Machine Drawing.

Required in I, II, III, IV and V.

Prerequisites: Courses 401 and 402.

Time: Junior year, first semester.

Laboratory, three periods a week.

Here the student makes working drawings from machine parts; first, while having this part directly before him, and later, from a freehand sketch of the part, without having the latter to look at while drawing. He thereby becomes familiar not only with methods of dimensions, laying out and reading working drawings, but also those of making and using sketches. Throughout the entire course particular stress is laid on neat lettering, correct dimensioning and symmetrical arrangement of drawings.

404. Machine Design.

Required in I and II.

Prerequisites: Courses 401, 402, 403, 105.

Time: Senior year, second semester.

Lectures, one period a week.

Laboratory, three periods a week.

A study of the design of machine elements and modern machines and of the nature, strength and action under stress of the materials used in machine construction. Recitations are carried on, including the discussion of problems suitable for illustration of important points. In the drafting room each student completes the design of some especially assigned machine.

405. Descriptive Geometry.

Required in I, II, III and IV.

Prerequisites: Courses 402 and 103.

Time: Junior year, first semester.

Lectures, two periods a week.

Laboratory, three periods a week.

The representation of all geometrical magnitudes is made possible by means of orthographic projections. The student is required to solve various problems involving points, lines, surfaces and solids and demonstrate same at blackboard.

406. General Surveying.

Required in I, II, III, IV and V.

Prerequisites: Courses 101 and 103.

Time: Freshman year, second semester.

Lectures, two periods a week.

Field Work, four periods a week.

An introductory course in surveying, including the use, care,

and adjustment of instruments; linear and angular measurements with the transit, level, compass and minor instruments. Students are given practice in traversing, computing areas, triangulating, topographic mapping and the keeping of accurate notes.

407. Mine Surveying and Mapping.

Required in I, II, III, IV and V.

Prerequisites: Course 406.

Time: Sophomore year, first semester.

Lectures, one period a week.

Field Work and Mapping, four periods a week.

The course involves lectures and recitations on the theory of Mine Surveying as applied both to surface claims and underground workings. Actual survey of the Merritt Mine and a complete map of the underground workings is required of each student.

408. Topographic Surveying.

Required in I, II, III, IV and V.

Prerequisites: Course 406.

Time: Sophomore year, second semester.

Lectures, two periods a week.

Field Work, four periods a week.

This course deals with use of transit and plane table in topographic surveying. Stadia and other methods used in locating topographical features. Use of triangulation and base lines also considered. A complete survey will be made and plotted.

409. Irrigation and Drainage.

Required in IV.

Prerequisites: 427, accompanying 410, 408 and 406.

Time: Senior year, first semester.

Lectures, five periods a week.

Field Work, three periods a week.

Part I. A course for Civil Engineers, embracing the study of irrigation and irrigation problems, including design of irrigation systems and the consideration of the adaptability of different soils to irrigation practice.

Part II. This course involves a discussion of the drainage problems inseparable from irrigation projects.

410. Railroad Surveying.

Required in I, IV and V.

Prerequisites: Courses 406, 408.

Time: Junior year, second semester.

Lectures, two periods a week.

Field Work and Drawing, three periods a week.

The course includes the study of the economic theory of railway location, computation of railway curves, transitions, turn-outs, and earth works. The field work involves preliminary and location surveys, computing, making notes for and locating simple and compound curves.

412. Mechanics.

Required in I, II, III and IV.

Prerequisites: Courses 106 and 201.

Time: Junior year, second semester.

Lectures, five periods a week.

This course treats of composition and resolution of forces, center of gravity, couples, conditions of equilibrium, moment of inertia, flexible cords, rectilinear, curvilinear and rotary motion, work, energy, friction, impact, etc.

413. Roads and Pavements.

Required in IV.

Prerequisites: Courses 406 and 410.

Time: Junior year, first semester.

Lectures, two periods a week.

Laboratory, three periods a week.

A study of the various methods of construction of the different types of roads and pavements, road materials, care of road surfaces, the proper use of paving materials and the economics of road building.

The laboratory work consists of testing wood materials and the solution of practical problems.

414. Railroad Engineering.

Required in IV.

Prerequisites: Course 410 accompanying.

Time: Junior year, second semester.

Lectures, three periods a week.

This course treats of the economical location and operation of

railroads, limiting gradients and curvature, train resistance, compensation for curvature, systems of signalling and general railroad organization.

415. Theory of Structures.

Required in IV.

Prerequisites: Courses 103 and 202.

Time: Junior year, first semester.

Lectures, three periods a week.

Laboratory, three periods a week.

The study of graphic statics and analytical methods as applied to roof and bridge trusses, involving loads, reactions, shears, moments, shear and moment diagrams and graphical analysis of trusses.

416. Cement Testing.

Required in IV.

Time: Junior year, second semester.

Laboratory, six periods a week.

The student is required to make the ordinary physical tests of cement, such as weight, specific gravity, fineness, time of set, pot tests, and the making and breaking of briquetts and cubes of neat cement and mortar.

417. Materials of Construction.

Required in I, II, III and IV.

Prerequisites: Courses 103, 202, 413 accompanying.

Time: Junior year, first semester.

Lectures, five periods a week.

The study of the principles of mechanics underlying the laws of the strength of materials; involving elastic and inelastic materials, their action under stresses of all kinds, results of tests of materials, curves of strength, a study of the strength of steel of varying composition and the fatigue of metals.

419. Masonry Construction.

Required in I and IV.

Prerequisites: Courses 204, 423 accompanying.

Time: Senior year, first semester.

Lectures, two periods a week.

In this course the attention of the student is directed chiefly

toward the use of cement as a building material; concrete and other forms of masonry are studied in foundations, piles, retaining walls, dams, buildings and bridges, practical problems in computation and design are included.

420. Air Compression and Pumping.

Required in I, 11 and IV.

Prerequisite: Course 427.

Time: Senior year, second semester.

Lectures, two periods a week.

Part I. Discussion of pumping, pump problems, and pump details. Types of pumps: Force pumps, crank and flywheel, direct acting, duplex, compound and triple expansion pumps.

Part II. A study of the action of air during compression and expansion; its flow through pipes; and, also, the various types of air compressing and actuating machinery.

421. Contracts and Specifications.

Required in IV.

Prerequisites: Courses 802 and 804.

Time: Senior year, first semester.

Lectures, two periods a week.

Laws of contracts covering contracts, agency, torts, and independent contractor; contracts of sale, association, transportation, etc. Study of engineering contracts and specifications with problems in contract and specification writing.

422. Engines and Boilers.

Required in I and IV.

Prerequisites: Course 202.

Time: Senior year, second semester.

Lectures, two periods a week.

Laboratory, three periods a week.

Part I. A general descriptive course on engines, their types, details, construction and management is given. The student is taught the use of the indicator, to take cards from an engine and correct the different valve events.

Part II. This course is devoted to the study of steam boilers. The lectures include the history, theory and design of modern steam boilers. Each student works out a complete design of a boiler.

423. Strength of Materials.

Required in I, II, III and IV.

Prerequisite: Course 204.

Time: Senior year, first semester.

Lectures, three periods a week.

This course is a study of the stresses and deformation of bodies subjected to tension, to compression, to shearing, to torsion; the study of elasticity of bodies; stresses in and design of pipes, riveted joints and hooks; treats of the theory of beams with discussion of bending moments, shearing forces and distribution of stress.

424. Bridge Design.

Required in IV.

Prerequisites: Courses 204, 423, 415.

Time: Senior year, second semester.

Lectures, two periods a week.

Laboratory, three periods a week.

A study of the different types of simple span bridges, trusses, cantilevers, plate girders, etc., and of the design of a bridge of a selected type.

425. Hydraulics.

Required in I, II, III and IV.

Prerequisite: Course 204.

Time: Senior year, first semester.

Lectures, two periods a week.

Study of fluid pressure, and laws governing the flow of water through orifices and pipes, over weirs, in closed conduits, and in open channels. The hydraulic laws relating to water wheels, etc., are briefly discussed.

426. Structural Design.

Required in IV.

Prerequisites: Courses 415 and 423.

Time: Senior year, second semester.

Lectures, three periods a week.

Laboratory, three periods a week.

A course in which each student is given a different set of data and is required to make computations, designs and working

drawings of several structures, such as a roof truss, plate girder and a riveted or pin connected bridge.

427. Hydraulic Engineering.

Required in IV.

Prerequisites: Courses 204, 425 accompanying.

Time: Senior year, first semester.

Laboratory, three periods a week.

A course for civil engineers in river hydraulics for power or irrigation, including the study of drainage areas, stream flow, discharge and rating curves, storage reservoirs for power or irrigation and the economics of water supply engineering.

428. Municipal and Sanitary Engineering.

Required in IV.

Prerequisites: Course 425.

Time: Senior year, second semester.

Lectures, two periods a week.

Laboratory, three periods a week.

A study of quantity of house-sewage and storm water, and the shape and dimensions of pipes and conduits for carrying the same. The use of flush tanks, man-holes and the ventilating systems.

429. Cost Keeping and Management.

Required in IV.

Prerequisites: Course 421 accompanying.

Time: Senior year, first semester.

Lectures, one period a week.

An elementary course on principles which govern the organization and management of labor on construction; systems of measurement, payment and efficient methods of cost keeping.

DEPARTMENT OF GEOLOGICAL ENGINEERING

PROFESSOR WELLS.

501. General Geology.

Required in I, II, III and IV.

Prerequisites: Entrance requirements.

Time: Sophomore year, first semester.

Lectures, three periods a week.

Occasional field trips.

This course is designed to give a thorough foundation on which to base the more advanced geological courses that follow. It consists of lectures, recitations, laboratory work with the common minerals and rocks, the study and interpretation of topographic maps, and occasional excursions into the field.

Dynamic and structural geology are the two branches of the subject receiving the greatest emphasis. The laws and methods of interpretation are discussed with considerable details, training in the deciphering of geological phenomena being the object sought.

The area surrounding Socorro is especially rich in varied and striking geological types. The old Socorro volcano, rising 2,500 feet above the campus, presents many typical rocks and many structures associated with volcanic districts. Sedimentary rocks of Pennsylvanian, Permian, Triassic, and Cretaceous age are well exposed a few miles to the east.

The local geological occurrences are utilized wherever practicable to illustrate the subject matter of the course.

502. General Geology.

Required in I, II, III and IV.

Prerequisite: Course 501.

Time: Sophomore year, second semester.

Lectures, three periods a week.

Historical geology comprises the major portion of the course. The various eras, periods, and epochs of the earth's history from cosmic to present time are studied in chronological order. The distribution and classification of the sedimentary rocks are taken up and the methods of correlation explained. In the study of

the life of the earth during earlier geological eras as recorded by the fossils, special attention is paid to the development of characteristic and predominant forms. Throughout the course those phases of historical geology are emphasized, the understanding of which is essential to the intelligent perusal of geological literature.

503. Economic Geology.

Required in I, II and III.

Prerequisites: Courses 501, 502, 509 and 510.

Time: Junior year, first semester.

Lectures, two periods a week.

This course, together with course 504, takes up the origin, nature, and occurrence of the economically valuable mineral deposits, both metallic and non-metallic; the various deposits being classified according to their origin rather than their chemical composition. Type forms, especially those developed in the United States, are emphasized. Among the non-metallic deposits studied are coal, oil, gas, cements, gypsum, salt, sulphur, clay, building stones, abrasives, gems, soils, and fertilizers. The study of the metallic ore deposits includes those of iron, copper, lead, zinc, silver, gold, platinum, and minor metals. Many New Mexico deposits are considered.

504. Economic Geology.

Required in I, II and III.

Prerequisite: Course 503.

Time: Junior year, second semester.

Lectures, three periods a week.

In this course the work outlined in course 503 is completed. Most of the time is given to a study of the deposits worked for the common and rare metals.

505. Oil and Gas Geology.

Required in III.

Prerequisites: Courses 503, 504, 511 and 512.

Time: Senior year, first semester.

Lectures, two periods a week.

This course deals with the origin of oil and gas, stratigraphy and structure applied to oil and gas, accumulation, locating wells, drilling, prospecting and geological mapping, reports on

oil and gas prospects and properties, valuation of properties, oil and gas fields of North America, and oil shales.

506. Ore Deposits.

Required in I, II and III.

Prerequisites: Courses 503 and 504.

Time: Senior year, second semester.

Lectures, three periods a week.

Deposits of the metallic ores are here treated more intensively than is possible in the time allotted to Course 504. The principles of secondary enrichment receive detailed treatment; also their application to the various types of ore deposits. The chemistry and mineralogy of secondary enrichment are considered with the purpose of giving the student sufficient knowledge along these lines to determine whether a given ore deposit is of primary or secondary origin and whether or not it is liable to continue to considerable depths. The important ore deposits of the United States which are characterized by secondary enrichment are carefully studied in that connection.

507. Field Geology.

Required in I and III.

Prerequisites: Courses 501, 502, 503, 504, 509, 510, 511, 512, 408.

Time: Senior year, first semester.

Lectures, one period a week.

Field work, eight periods a week.

While actual field practice comprises the larger part of the work, a considerable portion of the time is devoted to the writing of reports, office work in the construction of geological maps and sections, and the study of similar maps of the United States Geological Survey. The field work consists both of the rapid mapping of geological formations in large areas and the accurate location and mapping of formation boundaries, faults, vein outcrops, etc., in restricted areas. Practice is given in the use of the plane table and alidade when the party consists of several members, and of the small plane table and the geologist's compass as utilized for geological mapping when no assistant is available. Geological boundaries are also located on topographical maps with the aid of the contours alone. The report required at the end of the course includes the probable geological history,

classification of formations, and dominant geological processes illustrated in the area studied, as well as appropriate geological maps.

508. Applied Geology.

Required in III.

Prerequisite: Course 507.

Time: Senior year, second semester.

Lectures, two periods a week.

Field work, eight periods a week.

This course is designed primarily for students specializing in geological engineering. The field work is confined as far as practicable to neighboring mining districts and includes the study of the various surface structures, vein outcrops, underground and surface geological mapping, and the solution of problems dealing with the methods of ore deposition and occurrence. The petrographic and chemical examination of the rocks and ores under consideration constitutes a portion of the course. The work given may be varied in part according to the preference of the student.

509. Mineralogy.

Required in I, II, III, IV and V.

Prerequisites: Courses 301, 302 and 304.

Time: Sophomore year, first semester.

Lectures, three periods a week.

Laboratory, three periods a week.

Crystallography occupies a portion of the first ten weeks of the course. Only those phases are emphasized which are of practical value in the determination and proper understanding of minerals, the drill in this portion of the subject being quite thorough. In the laboratory work each student is required to become familiar with the various crystal forms as illustrated by the large number of crystal models and well-developed crystal minerals in the school collection. Proficiency is required in the determination of interfacial angles by means of the contact goniometer and the determination of the crystal form of microscopic crystals by examination with the hand lens.

Practice in the determination of the elements found in minerals accompanies the instruction in crystallography. Blow-pipe identifications are emphasized as far as is consistent with

dependable results. For those elements which do not give distinctive reactions in blow-pipe analysis, the most satisfactory wet methods of determination are used.

After the completion of the above work the minerals are taken up in systematic order. Over two hundred and fifty of the more common minerals are considered in this and the following course, stress being placed on their recognition by means of crystal form, cleavage, hardness, specific gravity, luster and other physical properties. The order of study followed in the lectures is: The elements, sulphides, sulpho-salts, haloids, oxides, aluminates, ferrites, hydroxides, carbonates, phosphates, nitrates, borates, sulphates, tungstates, molybdates, and silicates. The relative values of the minerals, both from the standpoint of economic use and mineralogical significance are emphasized.

510. Mineralogy.

Required in I, II, III, IV and V.

Prerequisite: Course 509.

Time: Sophomore year, second semester.

Lectures, three periods a week.

Laboratory, three periods a week.

The study of the individual minerals begun in Course 509 is here continued. The latter portion of the semester's work is spent in the determination of the unknown minerals both in the usual form of occurrence and in a powdered condition. Those minerals which cannot be determined by physical characteristics are tested by appropriate blow-pipe and wet methods. The ability to identify the common minerals alone and in combination as they are likely to be found in field practice is the aim kept in view.

511. Petrology.

Required in I and III.

Prerequisites: Courses 501, 502, 509 and 510.

Time: Junior year, first semester.

Lectures, one period a week.

Laboratory, three periods a week.

The effective study of rocks in their different aspects is the purpose of this, and the following courses, which are here described together. The igneous, sedimentary and metamorphic

divisions are taken up in considerable detail, both from a megascopic and microscopic standpoint.

The classification of rocks according to Kemp, together with the theory and manipulation of the petrographic microscope and the study of oriented sections of a large number of individual minerals, occupy the first eight weeks of the course. Upon the completion of this work, the various rock species are considered, the attention paid to any particular type being determined by its frequency of occurrence and importance in general geological practice. Thin sections of the various rock specimens in the collection are used as far as possible, so that the student may have the benefit of comparing and confirming megascopic determinations with the more accurate results of microscopic examination.

The microscope is also used to unravel the relations of the individual minerals in fine grained rocks, their order of crystallization, and other characteristics that are not apparent in the examination with the hand lens alone. In this connection the sedimentary and metamorphic rocks, as well as the igneous varieties, are utilized.

Along with the above work general metamorphic processes, both constructive and destructive, are given considerable attention, especially as they affect the development of the various rocks.

512. Petrology.

Required in I and III.

Prerequisite: Course 511.

Time: Junior year, second semester.

Lectures, one period a week.

Laboratory, three periods a week.

The work given under Course 511 and 512 is conducted throughout the year as described under the former course.

513. Paleontology.

Required in III.

Prerequisites: Courses 501 and 502.

Time: Senior year, first semester.

Lectures, two periods a week.

Laboratory, three periods a week.

This course is intended primarily for those specializing in

geological engineering and is a much more thorough course than can be given in the brief time allotted to Paleontology in Course 502. It includes the study of the invertebrate index fossils characteristic of the geological horizons of North America.

514. Ore Deposits.

Required in III.

Prerequisites: Courses 503 and 504.

Time: Senior year, second semester.

Lectures, five periods a week.

The material here offered is the same as that given under Course 506 with some additional instruction along similar lines for the benefit of geological engineers. Three of the five periods are the same as in Course 506. The other two periods are given as arranged for at the convenience of the instructor and the students taking the course.

515. Petrology.

Required in III.

Prerequisites: Courses 501, 502, 509 and 510.

Time: Junior year, first semester.

Lectures, one period a week.

Laboratory, six periods a week.

This course is offered for those following the geological engineering curriculum. It is an amplification of Course 511, the work given in the lectures and for three periods a week in the laboratory being the same as in the briefer course, and at the same hours. The additional laboratory work is utilized for more searching examinations of slides and hand specimens and for the consideration of a greater variety of rocks.

516. Petrology.

Required in III.

Prerequisite: Course 515.

Time: Junior year, second semester.

Lectures, one period a week.

Laboratory, six periods a week.

This course is a continuation of Course 515. With the exception of three laboratory periods of each week, which are conducted by special arrangement as to time, the work is the same as given in Course 512.

517. Ore Genesis.

Elective.

Prerequisites: Courses 503 and 504.

Time: Senior year, either semester.

Lectures, two periods a week.

Laboratory, three periods a week.

The study of the paragenesis and origin of the minerals of a certain ore deposit. The student makes a collection of the deposit, which is then studied in the laboratory by means of microscopic slides and polished surfaces, microchemical tests, etc. This is a special course to be given at the request of a sufficient number of students.

518. Special Problems.

Elective.

Prerequisites: Courses 503, 504, 506 and 507.

Time: Senior year, second semester.

Laboratory, five periods a week.

Research work in some branch of the science of geology, such as investigation in petrology, stratigraphy, paleontology, or ore deposits. This work may form the basis of a thesis in Geological Engineering.

DEPARTMENT OF MINING ENGINEERING

PROFESSOR SNYDER

601. Principles of Mining.

Required in I, II, III and IV.

Prerequisites: Courses 104, 202, 201, 301.

Time: Junior year, first semester.

Lectures, two periods a week.

The following subjects are studied:

Mineral deposits, their classification from a mining standpoint and their irregularities as affecting the work of exploration and mining.

Prospecting by panning, trenches, test pits, boring and drilling. Testing of placers and ore deposits with well or chain drills.

Excavation of earth; tools; methods; supports.

Excavation of rocks; explosives, kinds, nature, manufacture and use; methods of drilling and blasting, mammoth blasts; quarrying.

Machine drills: Construction and operation.

Tunneling: Methods of driving and timbering; permanent linings; sizes, speeds of advance and costs.

Boring: Methods and appliances for small depths and for deep boring; the diamond drill; survey of bore holes.

Shaft-sinking: Methods and tools for both hard and soft material; sinking; lining; handling and hoisting of material; timbering, walling and tubing.

Methods of support: Pillars, timbers, filling.

Surface-handling and transportation; arrangements for loading, unloading and storage of minerals; mineral railroads and common roads.

Ore extraction by systems of overhand and underhand stopping; caving by top slicing and sub-drifting; support of workings by filling and square setting.

Underground haulage: Mine cars; arrangement of tracks; hand tramming; mule and rope haulage; gravity roads; steam, compressed air and electric locomotives.

Hoisting: Engines, drums, wire rope, skips and cages; head-frames; calculation of power required and methods of equalizing the load on the engine; devices for prevention of over-winding; shaft-sinking plant.

Arrangements at top and underground landings: Ore-pockets; signaling, etc.

Drainage: Buckets, tanks and head-pumps; Cornish and direct-acting underground pumps; operation of pumps by electricity, compressed air and hydraulic power.

Ventilation: Natural ventilation, underground furnaces, positive blowers and centrifugal fans; efficiency of fans.

Illumination: Candles; torches, lamps classified as oil, gasoline, magnesium, acetylene, electric and safety.

Accidents to men from fire-damp, dust explosions, mine-fires, falling material and inundations; prevention; rescue and relief.

602. Principles of Mining.

Continuation Course, 601, two periods per week.

603. Ore Dressing.

Required in courses I, II, III and V.

Prerequisites: Courses 104, 201, 701 accompanying.

Time: Senior year, first semester.

Lectures, four periods a week.

Laboratory, three periods a week.

This course includes a detailed study of severing by means of breakers, rolls, stamps and fine grinding machines; the sizing and classification of pulps by mechanical, pneumatic, and hydraulic processes; the principles and importance of sizing and classifying; the separation and concentration by hydraulic and electrical methods and also by means of flotation processes.

604. Ore Dressing.

Required in I, II and III.

Prerequisites: Courses 104, 201, 603.

Time: Senior year, second semester.

Lectures, two periods a week.

This course is a continuation of Course 603.

605. Mine Examination.

Required in I and III.

Prerequisites: Courses 701, 702, 502, 407, 408.

Time: Senior year, first semester.

Laboratory, four hours a week.

Lectures, one period a week.

The main object sought in this course is to train the student sufficiently in expert mine examination work to enable him to report intelligently upon a mining proposition as to the advisability of purchase or of operation.

Practice is afforded in making regular reports, complete in every respect, on different kinds of mining properties. Each student is assigned a different mine or property to examine. In case the mine has been reported upon in previous years, detailed comparison of the results is afterwards made.

Among the more important topics usually considered are the topography of the district as an index to its accessibility, outside construction, the character of the geological formations, the geological structure (particularly as affecting the ore bodies), the character and disposition of the ores, the amount of ore developed, the probable extent of the unexplored part of the deposit, the best method of extracting the ore, of concentrating it, of preparing it for shipment or treating it immediately for the metal, the water facilities and the facilities for transportation to market. Full computations are required, including estimates of the cost of each process, of the necessary plant.

607. Mine Administration and Accounts.

Required in courses I, II, III.

Prerequisites: Courses 407, 408, 502, 701, 702.

Time: Senior year, first semester.

Lectures, two periods a week.

Particular stress is laid on the business aspects of mining operations. The value of keeping tabulated record of different grades of work and its cost from day to day is urged as a means of constantly reducing the fixed charges and of doing away with much of the extraordinary expenditures without reducing the efficiency of the work. The devising of methods of increasing the output with limited working forces is emphasized.

The subject of labor in its various phases, the details of supplies, mine accounts, statements of cost, and monthly reports are discussed.

608. Design of Mine Plant.

Required in I and III.

Prerequisites: Course 603.

Time: Senior year, second semester.

Laboratory, three periods a week.

The student is assigned problems relating to a given mine. He makes the requisite surveys, plans the top-works, selects the requisite machinery for a special duty, and designs in detail and makes working drawings of those features of Hoisting, Haulage, or Drainage Plant, or of the Ore Handling Plant, as may be assigned to him. On these portions he draws up specifications, bills of materials, and estimates of cost.

If an operating mine be selected for this, the entire work is examined, improvements incorporated, and suggestions made as to possible savings.

610. Mining Law.

Time: Senior year, second semester.

Lectures, two periods a week.

This course is designed to give the student a working knowledge of the mining laws of the United States and of the various states. The statutes will be discussed and compared, and the leading cases will be studied. The mining claim will be followed from its inception upon the open, unappropriated public domain, through the various steps of discovery, location, development, abandonment, forfeiture and re-location, up to and including the proceedings for patent. Conflicts, interference of claims, cross and uniting lodes, extralateral rights, parallel end lines and similar questions will be dealt with from the standpoint of the practical miner, so far as possible.

This course will be devoted primarily to lode claims, but will close with a few lectures on placers, millsites and tunnels.

Text book: Costigan's *American Mining Law*.

DEPARTMENT OF METALLURGICAL ENGINEERING

PROFESSOR SNYDER.

701. Fire Assaying.

Required in I, II, III and V.

Prerequisites: Courses 305, 306, 502, 509, 510.

Time: Junior year, first semester.

Lectures, two periods a week.

The instruction in assaying is given by means of lectures and laboratory experimentation, the practice in the laboratory illustrating the lecture-courses. The laboratory is well equipped with several different types of assay-furnaces for crucible work, scorification, and cupellation, and with everything that goes to make up a well furnished assay-office.

This course comprises fusion methods for gold, silver and lead. The crucible-assay of oxidized ores for gold and silver in the muffle and in the pot-furnace; crucible assay of sulphide ores for gold and silver by the iron, roasting, and preliminary fusion methods; also the crucible assay of lead ores. The scorification-assay of litharge and lead. In the assay of base-bullion, silver-bullion and gold-bullion, the methods in use in the United States mints are followed. Sampling and the preparation of the sample for assay; making cupels, and the management of the assay office and the special duties of practical assayers are considered.

Numerous samples are provided, all of which have been previously accurately assayed at the School, at the smelter whence they came, or at the mint. The student works upon these until he attains a high degree of proficiency. No student is allowed to pass this subject until he has become an experienced assayer.

702. Fire Assaying Laboratory.

Required in I, II, III and V.

Prerequisites: Courses 305, 306, 502, 509, 510, 701.

Time: Junior year, second semester.

Laboratory, eight periods a week.

This course is the laboratory work of Course 701.

703. Principles of Metallurgy.

Required in I, II, III and V.

Prerequisites: Courses 301, 201, 202, 509.

Time: Junior year, first semester.

Lectures, five periods a week.

A study of the physical and chemical properties of ore and metals as determinants in extraction-methods; furnaces, their classification and structure; fuels and thermal measurements; characteristic metallurgical processes; materials and products of metallurgical process; alloys; thermal treatment of metals preparatory to their use.

Particular stress is laid upon the study of the more recent metallurgical practices and improvements of older processes. The course is supplemented by visits to neighboring plants.

704. Metallurgy of Iron and Steel.

Required in I, II, III, IV and V.

Prerequisites: Courses 301, 509, 703.

Time: Junior year, second semester.

Lectures, five periods a week.

This course takes up the metallurgy of iron and steel in detail, in the following order, properties of iron, its alloys and compounds; specifications for standard iron and steels; ores of iron and the preparation of them for the blast furnace and its operation; manufacture of pig iron and its properties; calculation of furnace charges; chemistry of the blast furnace and the operation of same; blowing engines; furnace gases; treatment of flue dust; manufacture of steels by the basic and acid Bessemer processes; basic and acid Open Hearth processes; crucible steel manufacture; the making of wrought iron; structure of iron and steel; mechanical and heat treatment.

705. Metallurgy of the Non-Ferrous Metals.

Required in I, II, III.

Prerequisites: Courses 703, 704.

Time: Senior year, first semester.

Lectures, five periods a week.

This course includes a study of the metallurgy of lead, copper, zinc, gold, silver, antimony, nickel, tin, bismuth, and tungsten. They are given in the order listed below:

Metallurgy of Gold and Silver.

Occurrence of gold and silver; placer mining; the patio process; crushing and amalgamating machinery; pan amalgamation; chlorination by the vat and barrel process; cyaniding by the MacArthur-Forest and Siemens-Halske processes; modern

methods of cyanide treatment of slimes by pressure and vacuum filters; lixiviation of silver ores; pyritic smelting, refining and parting of gold bullion.

Metallurgy of Copper and Lead.

Occurrence of copper; roasting copper ores in heaps, stalls and roasting furnaces; blast-furnace smelting; pyritic smelting; reverberatory smelting; bessemerizing copper mattes; electrolytic refining of copper; selection of process and management of plant; occurrence of lead ores; methods of roasting and roasting furnaces; Corinthian, Silesian and English methods of reverberatory smelting; blast furnace smelting; calculation of blast furnace charges; and desilverization of base bullion, etc.

Metallurgy of Zinc and Minor Metals.

This subject takes up the roasting of zinc ores; zinc distillation process; furnaces; purification of spelter; and commercial consideration of such metals, also note the metallurgy of Antimony, Nickel, Tin, Bismuth, Tungsten and Arsenic.

706. Metallurgy of the Non-Ferrous Metals.

Required in I, II, III.

Prerequisites: Courses 703, 704, 705.

Time: Senior year, second semester.

Lectures, five periods a week.

This course is a continuation of Course 705.

708. Metallurgy Laboratory.

Required in I, II.

Prerequisites: Courses 705, 706, 701.

Time: Senior year, second semester.

Lectures, one period a week.

Laboratory, eight periods a week.

Laboratory work and investigation will be conducted along some of the following lines: Amalgamation of ores of gold and silver, chlorination of gold and silver ores, cyanidation of gold and silver ores, leaching methods for copper ores, electrolytic refining for copper and lead, slags.

Note. Analyses of water are made in regard to their possible use in boilers. These analyses involve the determination of total solids, organic and volatile matter, silica, iron and alumina, calcium, magnesium, sodium, potassium, and carbonic, sulphuric and hydrochloric acids.

Analyses of various coals and other fuels are made, their heat values calculated from these analyses and also determined by

means of a calorimeter. Flue gases are analyzed and the results interpreted. The flash-point, burning point, specific gravity, viscosity and acidity of oils are determined.

This work also includes the laboratory work to be done in Ore Dressing as listed in the Senior year, first semester, three hours a week.

709. Metallurgical Calculations.

Required in II.

Prerequisites: Courses 703, 704.

Time: Senior year, first semester.

Lectures, one period a week.

A course based on Richard's Metallurgical Calculations. It is designed to bring the student in contact with the more important calculations in connection with the practice of thermo-chemistry and various smelting operations, also electro-metallurgy.

711. Metallurgical Plant Design.

Required in II.

Prerequisites: Courses 415, 703.

Time: Senior year, first semester.

Lectures, one period a week.

Laboratory, six periods a week.

The student devotes his time to detailed and original plans for a plant for ore treatment. From year to year the conditions vary so that no two students have the same work. The working plans for part of the buildings, concentrators, furnaces, etc., are drawn up complete in every respect, the full bills of materials are made out for the portions of the work assigned, and the cost of the several parts carefully estimated according to the trade conditions and labor factors existing at the time. The entire work and all computations are carried out according to the best engineering practice and with the same care that actual construction operations require.

712. Metallurgical Plant Design.

Required in II.

Prerequisites: Courses 415, 703, 711.

Time: Senior year, second semester.

Laboratory, six periods a week.

This is a continuation of Course 711.

713. Metallography.

Required in II.

Prerequisites: Course 703.

Time: Senior year, first semester.

Lectures, two periods a week.

Laboratory, three periods a week.

This work is a course of lectures including the study of the micro-structure of iron and steel, of the non-ferrous metals, some commercial alloys and the influence of heat treatment, also mechanical, on these structures; the study of equilibrium and of the phase rule applied to alloys.

The laboratory work consists of the preparation and microscopical examination of the variously treated iron and steel alloys and the photographing of their structures; also the construction of equilibrium diagram of alloys.

714. Electro-Metallurgy.

Required in II.

Prerequisites: Courses 703, 705.

Time: Senior year, second semester.

Lectures, two periods a week.

A series of lectures are given covering the electro-metallurgical processes in use at the present time as well as the necessary calculations of efficiency and engineering based on these.

Mining and Metallurgical Trips.

During the Junior and Senior years occasional trips are taken to the mines, mills, and smelters which are within easy reach of the School. The officials at the various plants have been uniformly courteous in allowing the School the opportunity to make these visits, and have placed at the disposal of the students everything essential to a clear understanding of the mode of operation.

The excursions give the student a chance to see in operation and practice what heretofore he may have known only theoretically and give him a command of the subject that cannot be obtained in the class-room.

Among the properties visited and at the disposal of the School are:

The old Tarrance and Merritt mines, three miles from the campus, in the Socorro Mountains. These mines were once rich producers, but are now being re-exploited.

The Merritt Mine has an incline shaft equipped with gasoline hoist and self-dumping skip, and a considerable amount of drifting, raises, winzes, and stopes. Practically all the operations of mining may be seen at these two mines.

The coal mines of Carthage, New Mexico, are within easy reach of the School and present to the student practical problems and their solution, in mining, haulage, ventilation, and water supply. The use of electricity in mining is prominently brought to the student's notice.

The zinc district at Kelley, New Mexico, brings out the fact that success in mining is not all luck. There are three large mines and three mills available for inspection, and the student sees in the mines that geology is a live subject and essential to successful mining. In the mills, he gets his first insight into ore dressing and learns that there is more than one way of doing the same thing.

The Southwestern Portland Cement Company's plant at El Paso is visited and studied from the mechanical point of view. Here are seen in action various types of crushers, grinders, elevators, conveyors, feeders, etc. The company's quarry is a fine example of open cut mining and the student sees the uses of churn drills in drilling holes for blasting large charges.

At the smelter in El Paso, the student sees the working and handling of a large custom plant. Practically everything in the line of copper, lead, and silver smelting is before him for inspection. The methods of sampling, the blast roasting of lead ores, the roasting of copper ores, the blast furnace treatment of lead-silver ores, the blast furnace treatment of copper ores, the reverberatory smelting of copper ores, basic converting, casting machines, power houses, and assay offices are all made the subject of close observation.

DEPARTMENT OF ENGLISH AND SPANISH

PROFESSOR REYNOLDS.

The aim of the courses of instruction in this department is to train the student in the correct use of English and Spanish and to give facility in the writing and speaking of each.

801. English.

Required in I, II, III, IV and V.

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, three periods a week.

A study of the theory of exposition, with special attention to the correct and effective sentence and the proper use of the paragraph. A definite amount of written work is required in order that the student may gain facility in the use of clear, idiomatic English. The subject matter for written work is frequently drawn from other courses pursued by the student, thereby correlating this work with that of other departments.

802. English.

Required in I, II, III, IV and V.

Prerequisite: Course 801.

Time: Freshman year, second semester.

Lectures, three periods a week.

This course is a continuation of 801. Oral expression and composition is a definite part of the class work. Reference reading is required.

803. Technical Business Forms and Reports.

Required in I, II, III, IV and V.

Prerequisites: Courses 801 and 802.

Time: Sophomore year, first semester.

Lectures, two periods a week.

A study of the best methods of oral and written exposition of the details and problems of engineering and journalistic writing.

804. Technical Business Forms and Reports.

Required in I, II, III, IV and V.

Prerequisites: Courses 802 and 803.

Time: Sophomore year, second semester.

Lectures, two periods a week.

805. Spanish.

Required in I, II, III, IV and V.

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, four periods a week.

Attention is given to the elementary principles of the grammar of the language with the idea of learning the grammar from the language rather than the language from the grammar. Special stress is placed upon conversational exercises.

A part of the class exercise each day consists of cross-translations, both oral and written.

806. Spanish.

Required in I, II, III, IV and V.

Prerequisites: Course 805.

Time: Freshman year, second semester.

Lectures, four periods a week.

A continuation of Course 805. It involves translations and prose writing and practice in oral expression. Emphasis is placed on the correct grammatical sentence.

807. Spanish.

Required in I, II, III, IV and V.

Prerequisite: Course 806.

Time: Sophomore year, first semester.

Lectures, three periods a week.

This course consists almost entirely of Commercial Spanish. Business letter writing, reports, and technical expressions receive special attention. Conversation and sight translation give the student an opportunity of acquiring a good working knowledge of the language.

808. Spanish.

Required in I, II, III, IV and V.

Prerequisite: Course 807.

Time: Sophomore year, second semester.

Lectures, three periods a week.

This course is a continuation of Course 807.

809. Spanish.

Prerequisite: Course 808.

Time: Junior year, first semester.

Lectures, three periods a week.

This is an advanced course in scientific and technical Spanish, in which an exhaustive study is made of the vocabulary of Min-

ing, Metallurgy, Electricity, etc.; intensive work is done in report writing, conversation and sight translations.

810. Spanish.

Prerequisite: Course 809.

Time: Junior year, second semester.

Lectures, three periods a week.

A continuation of Course 809.

ACADEMIC DEPARTMENT

PRINCIPAL COOK

The courses regularly offered in the Academy are:

FIRST SEMESTER

901. Elementary Algebra.

Time: Five periods a week.

A rapid review of the fundamental operations of algebra will be given during the first part of the semester. Factoring, fractions, linear equation, radicals and quadratics will be given special attention.

905. Plane Geometry.

Time: Five periods a week.

Triangles, quadrilaterals, loci, arcs, chords, measure of angles, and simple problems in construction are studied.

918. English III.

Time: Five periods a week.

The purpose of this course is to give the student a thorough knowledge of the fundamentals of Grammar, Rhetoric and Composition. A considerable amount of composition, both oral and written, is required; thus enabling him to acquire facility of expression.

915. Physics.

Time: Four periods a week.

Laboratory, three periods a week.

This course runs throughout the entire year, the aim being to familiarize the student with the principles of physics, and to serve as an introduction to applied mathematics. Attention is given to the preparation of records, and to the manipulation of apparatus. During this semester the subjects of mechanics, heat and work are studied.

SECOND SEMESTER

908. Plane Geometry.

Time: Five periods a week.

Work of the first semester is continued. The course is vitalized by solutions of simple exercises and practical problems requiring the use of the algebra of the previous year.

922 Solid Geometry.

Time: Five periods a week.

The work for the second semester includes the usual theorems and constructions covering the relations of lines and planes in space; the properties and measurements of prisms, pyramids, cylinders, and cones; the sphere; and the spherical triangle.

Drawing.

Instruction in elementary drawing is given to meet the requirement of the School for entrance into Freshman drawing.

920. Physics.

Time: Class-room, three periods a week.

Laboratory, six periods a week.

This is a continuation of the first semester's work. Sound, light, and electricity are treated in much the same manner as the subjects of the first half of the year. Throughout the course individual laboratory work is required. Each student must present a satisfactory note book of at least forty experiments performed by him during the year before credit will be allowed by instructor.

GENERAL INFORMATION

EXPENSES

Matriculation Fee

A matriculation fee of five dollars is required of each student at the time of registration. This fee is paid but once.

Tuition Fee

The fee for tuition is five dollars a semester for residents of New Mexico and fifteen dollars a semester for non-residents.

Athletic Fee

An athletic fee of five dollars a semester is required of each student and is payable to the Registrar upon registration. This will be paid by the Registrar to the Treasurer of the Athletic Association upon the written statement of the Secretary of the Association that the student has signed the constitution. Payment of this fee entitles the student to a season ticket which admits to all athletic contests on the home grounds. Funds obtained from the athletic fees will be put at the disposal of the Athletic Association.

Laboratory Fees

The laboratory fees are intended to cover the cost of materials for which the student does not pay directly and to compensate for the depreciation, due to use, in the value of the apparatus. These fees are payable at the time of registration for each subject, and are as follows:

Chem. 301, General Chemistry.....	\$ 7.50
Chem. 304, Qualitative Analysis	7.50
Chem. 305, Quantitative Analysis	7.50
Chem. 306, Quantitative Analysis.....	7.50
Chem. 307, Water Analysis	5.00
Chem. 308, Electro-Analysis	5.00
Chem. 314, Organic Chemistry.....	7.50
Met. 702, Fire Assaying.....	10.00
Geol. 509 and 510, Mineralogy (includes Triple Aplanat lens)	8.00
Met. 708, Metallurgical Laboratory.....	3.00
C. E. 411, Shop.....	5.00

Phys. 201, Physics.....	4.00
Phys. 202, Physics.....	4.00
Phys. 203, Direct and Alternating Currents.....	5.00
Academy 915 and 920, Elementary Physics.....	3.00
C. E. 406, Surveying Laboratory.....	2.00
C. E. 407, Mining Surveying Laboratory.....	2.00
C. E. 408, Topograph Surveying Laboratory.....	2.00
C. E. 410, Railroad Surveying Laboratory.....	1.00

The number of fees which a student is required to pay varies with the different curricula. A number of the above fees are for special courses. The charge for laboratory fees in the Freshman year is \$20.00 and in the Sophomore year is \$29.00. The average yearly charge for laboratory fees in the Junior and Senior years in the various curricula is \$20.00.

A deposit of \$2.00 is required from each student who registers for any of the foregoing courses. This deposit will be returned to the student after deducting any amount which may be due from the breakage or damage to apparatus.

The graduation fee, payable on delivery of diploma, is as follows:

Mining, Metallurgical, Geological, or Civil Engineer.....	\$25.00
Bachelor of Science.....	5.00

Board and Rooms

Rooms may be obtained at a cost varying from \$10.00 to \$15.00 a month.

Dormitory Accommodations

Students are accommodated with board and lodging at the dormitory at the rate of \$30.00 a month, they being required to furnish only their own bed covering. This rate is fixed for cases in which two students occupy the same room. Five dollars a month additional is charged a student who wishes a room by himself, and no student will be accommodated in this way to the exclusion of another student from dormitory privileges. These fees are required to be paid monthly in advance. A deposit of five dollars is required, also, of each student in the dormitory to cover the cost of possible breakage or damage to his room or its furniture. After paying the cost of such damage or breakage, if any, the balance of this fee is returned to the student at the end of the year.

Rooms in the dormitory are assigned to students in the order of application. Dormitory privileges will be withdrawn from

any student for boisterous and disorderly conduct in violation of the rules and regulations governing their action while in or about the building. The privilege of the dormitory, is therefore, for students of good behavior and those who wish to study, without being interrupted.

Book and Other Supplies

Books and other supplies for students are furnished through the office at publishers' prices with the freight or express charges added. A considerable saving is thus made in behalf of the student.

SCHOLARSHIPS

Instructor's Scholarship.—Through the wisdom of the Board of Regents of the School of Mines, there have been provided from two to five scholarships, discretionary to the president, carrying free tuition and from \$150 to \$200 per year. These scholarships are awarded only to worthy young men who have satisfactorily completed at least the college freshman work and who are otherwise worthy of recognition. The students carrying such scholarships shall be selected by the president, and they shall be required to give from one hour to not more than two hours each day instructions in the class-room or in the field, shop, or in operating and having charge of machinery, etc., during the active school year, as they may be qualified in or are capable of doing.

School of Mines County Scholarships.—Scholarships are open to one student from each county in New Mexico. These scholarships yield free tuition and are awarded by the president to indigent and worthy students.

Allis-Chalmers Scholarships.—To one member of each year's graduating class there is offered by the Allis-Chalmers Company, manufacturers of mining and heavy machinery, with large works at Chicago, Milwaukee and Scranton, an opportunity for four months' study and employment in any of its plants and an emolument of \$150. This scholarship is awarded by the Board of Regents on the recommendation of the Faculty from those graduates of the year filing application before the 10th of June. The opportunity is an exceptional one to observe and study the building of all kinds of modern mining and metallurgical constructions.

ATHLETICS

Physical training has become a distinct feature of the student's activity at nearly all institutions of higher education. Rationally indulged in it is an exceedingly valuable feature, as is attested by past experience. The young man who gives promise of greatest usefulness, is sound in both mind and body. The health of the body and the consequent health of the mind cannot be promoted without proper attention to the laws of physical exercise. Physical training thus becomes, as it should become in an educational institution, a valuable means for the accomplishment of the very end and aim of the institution itself.

Care is taken to make athletics merely a means of keeping the young men at the School of Mines in the best possible physical condition to do the work for which they came to the institution. While it accomplishes this purpose it naturally fosters and develops a strong college spirit, and this, too, is a species of enthusiasm that is by no means to be despised in the work of educating young men for the activities of their later years.

Athletics are encouraged and fostered in every reasonable way. Football, baseball and basketball teams have been supported at various times and have usually established good records. Excellent tennis facilities are maintained for the use of the students.

STUDENTS' CLUB ROOM

A room in the dormitory 30 by 35 feet in size is fitted up as a Boys' Club Room. It is a general recreation room open at all times to the students of the School of Mines and is under the supervision of the Athletic Association. The room is supplied with furnace heat, an indirect lighting system and contains two pool tables, a piano, reading tables and comfortable chairs. In the future a fire place will be built, which will add to the comfortableness of the room.

The room has a very smooth floor, which has been varnished and waxed, making it excellent for dancing. Several dances are given during the year by the students to their friends.

A dozen or more popular magazines are to be found here, together with the leading engineering magazines and daily newspapers.

Not a more comfortable, cheery or home-like room will be found in any institution in the state.

The fitting up and furnishing of this club room has been made possible by the liberality of the Board of Regents, the generosity of the ladies of Socorro and the excellent co-operation of the student body.

"M" DAY

On the summit of Socorro Mountain, some three miles west of the School of Mines campus, at an elevation of about seven thousand feet, is located the school emblem. It is a huge block "M," 150 by 110 feet, constructed from boulders on the mountain side and painted white.

Because of its size and height, it can readily be distinguished with the naked eye a distance of more than fifty miles.

Tradition requires that the "M" shall receive annually, at the hands of the Freshman Class, a fresh coat of paint. A day, usually late in the fall, is set aside by the Faculty for this purpose; so that "M" Day is one of the recognized holidays at the School of Mines.

As the painting of the "M" is a rather strenuous task, "M" Day is one which lingers fondly in the memory of every Freshman.

METHOD OF GRADING

The following system of grading is used:

A—Excellent.

B—Good.

C—Fair.

D—Conditioned.

E—Failure.

Inc.—Incomplete.

Grades A, B, and C, carry credits.

D means student has not passed. The condition must be removed by passing a re-examination before the subject is repeated, otherwise it becomes an E. Only one re-examination will be permitted.

E means the subject must be repeated in class. At the discretion of the instructor an incomplete grade, designated "Inc.,"

may be given the student for failing to finish a course, which must be removed before the subject is repeated in class, otherwise the incomplete becomes a failure.

CONDUCT OF STUDENTS

In the government of the School of Mines the largest liberty consistent with good work is allowed. Students are expected to conduct themselves as gentlemen upon all occasions and to show such respect for law, order, morality, personal honor, and the rights of others as is demanded of good citizenship. It is also hereby expressly stipulated that the use of intoxicating liquors, whether inside or outside the campus, and the frequenting of places of questionable character are strictly prohibited. It is assumed that the act of registering as a student implies full acceptance of this policy. Failure on the part of any student to comply with this policy will be considered sufficient cause for removal from the institution.

SUMMER WORK

The proximity of the School to mineral properties, mines, and smelters makes it easy for the students to secure employment during the summer and at the same time to acquire much practical experience in the line of his profession. That this advantage has been appreciated is shown by the large proportion of students who yearly make use of this opportunity. During the past years, land-surveying, mine-surveying, geological surveying, assaying and mining, have been attractive fields of work for students during vacation.

CHEMICAL ANALYSIS, ASSAYING, AND ORE TESTING

The wide demand which exists in the great mining districts of the Southwest for disinterested and scientific tests and practical investigations has led to the establishments by the New Mexico State School of Mines of a bureau for conducting commercial work relating to mining and metallurgy.

The performance of such work is made possible and accurate results assured by reason of the exceptional facilities of the laboratories of the School and the extensive practical experience

of the instructors. The rapidly increasing amount of this work intrusted to the School is sufficient evidence in itself that the plan has been long needed to further the development of the mineral resources of the region.

A special act of the Legislature makes provision for carrying on commercial testing. The section from the law governing the School of Mines, Chapter 138, Section 38, Acts of 1889, reads: "The Board of Trustees shall require such compensation for all assays, analysis, mill-tests or other services performed by said institution as it may deem reasonable, and the same shall be collected and paid into the treasury of the School of Mines." By special resolution it is required that all charges shall be paid in advance. Prices for work will be sent on application.

FREE DETERMINATIONS

For the benefit of prospectors and others, elementary blow-pipe and physical tests will be made of any rocks, ores or other mineralogical material when sent to the School for their proper identification and classification. Such work is done to encourage prospecting and to more fully exploit the mineral resources of New Mexico so little comprehended at the present time. For such work as indicated in this paragraph no charges will be made.

SHORT COURSES

GENERAL STATEMENT

The Federal and State governments by recent legislation have outlined a building programme which involves the expenditure of millions of dollars on State Highways, County Roads, Irrigation and Drainage, and Reclamation projects. To adequately institute, carry on, and complete this construction will require a large force of graduate and under-graduate engineers. There is now a dearth of sufficiently well trained men to fill such vacancies as Highway Engineer, Transitman, Levelman, Hydrographer, Topographer, Draughtsman, Tracer, and others necessary to this type of work. In the field of Mining, Metallurgy, or Geology, many positions are open to the under-graduate—positions which are the stepping-stones of the graduate engineer to offices of influence and responsibility.

To meet this growing demand for men qualified for duties requiring a limited technical knowledge, and likewise to offer the opportunity to pursue certain favored fields of endeavor to that large class of ambitious young men who have not the necessary education to satisfy college entrance requirements, the New Mexico State School of Mines offers, in addition to the regular four-year curricula, short practical courses entitled (1) Highway Engineering. (2) Surveying. (3) Chemist, Assayer, and Surveyor. (4) Engineering Draftsman.

CERTIFICATES

The Certificate of Proficiency

The Certificate of Proficiency in Highway Engineering, Surveying, Chemist, Assayer, Surveyor, or Engineering Draftsman is conferred upon those who, as students of this institution, have completed the corresponding prescribed courses of any one of the several curricula.

Short Course Curricula

Highway Engineering.

Surveying.

Chemist, Assayer, and Surveyor.

Engineering Draftsman.

In the adjustment of the courses of the several curricula, it is assumed that one period of work in the class-room requires one period of preparation, and therefore that one period of work in the class-room is equivalent to two periods of work in the field or in the laboratory. In the following outlined statement of curricula the number of periods per week required in the class-room and in the field or in the laboratory are given separately. The number of periods required in the field or in the laboratory represents *average* time, however, inasmuch as it is frequently advantageous, especially for field work, to concentrate into one week an amount of work equal to that which would require two or more weeks if performed in separate installments.

ADMISSION

The short courses are open to all who, in the judgment of the Faculty, are sufficiently mature. In the Highway Engineering, and to a less degree, in the Surveying course, a knowledge of Algebra and Geometry is desirable, but students of special aptitude or with previous training can maintain the standard without this preparation.

HIGHWAY ENGINEERING

(Two Years)

This course is designed to give to the student an opportunity to specialize in this phase of engineering and to obtain a knowledge of the fundamentals of road building. The essential subjects of practical utility are carefully selected with the view of en-

abling the student to specialize at once.

The work of the first year in this course is practically identical with that of one one-year Surveyor course. Students who enter the latter course may elect to pursue the more advanced engineering.

Instruction is given in the use of surveying instruments of all types. Underground surveying and mapping is taught as an advanced course. The theory of railway location, simple and compound curves, spiral easement curves, earthwork, and the proper use of tables are carefully considered.

More advanced work is expected of the student in this course as he is studying cement and concrete construction, and general engineering structures. The instruction, however, is adapted to his needs and is of a strictly practical nature. On the completion of this course the student will be capable of handling lines of general engineering work not requiring advanced technical knowledge.

HIGHWAY ENGINEERING (Two Years)

FRESHMAN YEAR

Courses	Periods a week	
	Class	Lab'y
First Semester		
Algebra	4	0
Trigonometry	4	0
General Surveying	2	4
Mechanical Drawing	0	6
Elementary Mechanics	4	3
Roads and Pavements.....	2	3
Spanish or Elective	4	0
Second Semester		
General Surveying	2	4
Mechanical Drawing	0	6
Elementary Mechanics	4	0
Topographic Surveying and Mapping.....	2	4
Spanish or Elective	4	0
Elective	6	0

SOPHOMORE YEAR

Courses	Periods a week	
	Class*	Lab'y
First Semester		
Drainage and Irrigation	2	0
Architectural Drafting	0	3
Masonry Construction	2	0
Descriptive Geometry	2	3
Elective	6	0
Second Semester		
Mine Surveying and Mapping	1	4
Railroad Surveying	2	4
Bridges and Culverts	2	3
Architectural Design	2	3
Cement Testing	0	6
Elective	6	0

SURVEYING**(One Year)**

The one-year Surveying course is a study of the fundamentals of surveying, and consists mainly of the field and office work in this branch of engineering. The associated subjects—mathematics, drawing, etc.,—have been carefully selected to equip the student with all the necessary information.

Instruction is given in the use of the transit, level, plane-table, hand-level and Brunton transit or compass, and the general principles governing the adjustment of these instruments in practice. The student is required to perform actual land surveying, underground mine traversing and mapping, road traversing and platting, and the location of simple curves.

A study of roads and pavements is included in order that the student may have a clear knowledge of the best forms of road construction, the importance of proper drainage, and the best types of surfacing material.

SURVEYING**(One Year)**

Courses	Periods a week	
	Class	Lab'y
First Semester		
General Surveying	2	4
Trigonometry	5	0
Mechanical Drawing	0	6
Elementary Mechanics	4	3
Roads and Pavements.....	2	3
Algebra	4	0
Spanish or Elective.....	4	0
Second Semester		
Mine Surveying and Mapping	1	4
General Surveying	2	4
Mechanical Drawing	0	6
Elementary Mechanics	4	0
Bridges and Culverts	2	3
Topographic Surveying	2	4
Railroad Surveying	2	4
Spanish or Elective.....	4	0

CHEMIST, ASSAYER, AND SURVEYOR
(One Year)

This is pre-eminently a practical course. Instruction is given in only those subjects which will be of specific value to the student, yet includes all essentially important. The aim is to make of the student in one year's time a practical "combination man"—the man so often in demand for mines in the process of development.

Instruction in Chemistry is concentrated into thirty-six weeks. Appropriate lectures parallel the Qualitative and Quantitative laboratory determinations of all the common and a few of the rare metals. The methods taught are the short, rapid, up-to-date processes used in the West. This course is thorough in its character and covers well the subjects of instruction.

The Assaying lectures of the first semester convey the necessary chemical knowledge to prepare the student for laboratory work. This latter consists of the fire determination of all the common metals, those methods being taught which are of practical use, and which will qualify the student to satisfactorily fill the positions for which this course is designed.

The Surveying consists of one year instruction in the use of the transit, level, and other surveying instruments together with the necessary mathematics, mapping, and platting. Upon the satisfactory completion of this course, the student will be qualified to perform any of the ordinary work required of the land, road, or mine surveyor.

CHEMIST, ASSAYER, AND SURVEYOR
(One Year)

Courses	Periods a week	
	Class	Lab'y
First Semester		
General Surveying	2	4
Chemistry	4	9
Assaying	2	0
Mineralogy	3	3
General Geology	3	0
General Metallurgy or Spanish.....	5	0
Second Semester		
Mine Surveying and Mapping.....	1	4
General Surveying	2	4
Mechanical Drawing	0	10
Topographic Surveying	2	4
Railroad Surveying	2	4
Assaying	0	9
Mineralogy	3	3
General Geology	3	0
Chemistry	4	0

SHORT COURSE IN ASSAYING

This course is designed to meet the needs of the practical man or the ex-soldier who desires to take a short, concise course in practical assaying. The work consists mainly of laboratory work, supplemented by side reading in the subject. A student may put in every day in the laboratory if he so desires, thereby being enabled to finish the course in a much shorter time than the regular student. The work consists in assaying the different ores and metallurgical products supplied by the School. During the course the student has practice with the different types of furnaces used in assaying. The speed with which the student finishes the course is only limited by his own capabilities.

A man upon finishing this course in assaying should be competent to fill the position of assayer under most any circumstances.

ENGINEERING DRAFTSMAN**(One Year)**

The Engineering Draftsman course has been added to the curricula for those students who wish to prepare themselves for work in engineering or architectural offices. The associated subjects have been chosen with a view to further prepare the student for his chosen work.

One semester's work in surveying is required that the student may be familiar with the keeping of field notes, etc., and so be better equipped to compute and plot same in the office. Special attention will be given to the plotting and computing of field notes. The mathematics given are essential to designing, estimates, etc.

Before completing the course the student will be required to make an original design of a small building and write specifications for same.

ENGINEERING DRAFTSMAN**(One Year)**

Courses	Periods a week	
	Class	Lab'y
First Semester		
Mechanical Drawing	0	6
Algebra	4	0
Trigonometry	4	0
General Surveying	2	4
Architectural Drafting	0	3
Spanish or Elective	3	0
Elective*	4	0
Second Semester		
Mechanical Drawing	0	6
Topographic Mapping	0	3
Architectural Design	2	3
Descriptive Geometry	2	3
Solid Geometry	4	0
Spanish or Elective	3	0
Elective	4	0

*If student has not had Plane Geometry it must be taken in this semester.

**DIRECTORY OF GRADUATES
AND STUDENTS**

DIRECTORY OF GRADUATES AND STUDENTS[†]

ARTHUR H. ABERNATHY

Kelly, New Meico

Student, 1898-1901. From Pinos, Zacatecas, Mexico. Assayer, Cananea Smelting Works, Cananea, Sonoro, Mexico, 1901; Assistant sampler, Cia. Minera de Penoles, Mapimi, Durango, Mexico, 1909-1910; Sampling foreman same company, 1910-1914; Special student at New Mexico School of Mines, 1914-1915; Sampling foreman Cia. Minera de Penoles, Mapimi, Durango, Mexico, 1915-1916; Mine foreman, Ozark Mining and Smelting Co., Kelly, New Mexico, 1916-1918; Sampling mill foreman, Cia. Minera de Penoles, Mapimi, Durango, Mexico, 1920.

RAY COOK AHNEFELDT

Riverside, California

(B. S. in Mining Engineering and Civil Engineering, New Mexico School of Mines, 1918.)

Enlisted in Engineer Enlisted Reserve Corps, Feb. 1918; Entered Engineer Officers' Training Camp, Camp Lee, Virginia, May, 1918; commissioned Second Lieutenant July, 1918; died October, 9, 1918.

ANTONIO ABEYTA

Socorro, Mexico

(B. S. in Metallurgical Engineering, New Mexico School of Mines, 1914.)

Foreman at San Gertrudes Mine, Pachuca, Mexico, 1914-1916; Company I, U. S. Naval Training Station, San Francisco, Calif., 1917-1918; Medical Dept. Navy, 1920—.

EUGENE CARTER ANDERSON

Centerville, Mississippi

(B. S. in Mining Engineering, New Mexico School of Mines, 1917.)

Student, 1915-1917; U. S. Reclamation Service, 1917; Sergeant Company E, Twenty-third Regiment, U. S. Engineers, A. E. F., 1917-1919; State Highway Dept., Santa Fe, N. M., 1919—.

ALEXANDER H. ANDREAS, JR.

Laconia, N. H.

Student, 1915-16. Re-entered 1919.

FRANK M. ARMIJO

Socorro, N. M.

Entered Academic Class, 1919.

FLORENTINO BACA

Socorro, N. M.

Entered Freshman Class, 1919.

[†]Information concerning former students not here listed or concerning changes of address of those already listed will be gladly received.

GEORGE C. BAER

Mogollon, New Mexico

(B. S. in Mining Engineering, New Mexico School of Mines, 1910.)

Student, 1907-1910. From Hillsdale, Michigan. Assayer, Tri-Bullion Company, Kelly, New Mexico, 1910; Millman, Socorro Mines Company, Mogollon, New Mexico, 1911; Mill foreman, same company, 1912; Engineer, same company, 1912; Assistant superintendent, same company, 1914-1917; Supt. mines Matahambre Pina Del Rio, Cuba, 1917-1920—.

EDGAR A. BARNES

Lynn, Mass.

Entered Short Course Chemist, Assayer, and Surveyor, 1919.

FRED C. BARNARD

New Bedford, Mass.

Entered Freshman Class, 1919.

SIDNEY S. BARTLETT

Socorro, New Mexico

Entered Freshman Class, 1919.

PETER A. BALLARD

Rapid City, South Dakota

(B. S. in Mining Engineering, New Mexico School of Mines, 1916.)

Prospecting for oil in Wyoming, 1916-1918; Field geologist Midwest Refining Company, Casper, Wyoming, 1918-1920—.

JAMES HENRY BATCHELDER, JR.

Socorro, New Mexico

(B. S., New Mexico School of Mines, 1909; E. M., 1910.)

Student, 1906-1910. From Exeter, New Hampshire, Mining, Chloride, New Mexico, 1911; Supt. Highways, Socorro County, New Mexico, 1919. Firm of Batchelder & Ervin, Engineers, Socorro, New Mexico, 1919—.

THOMAS HORTON BENTLEY

Carney's Point, New Jersey

(B. S., New Mexico School of Mines, 1919; E. M., 1910.)

Student, 1907-1910. From Burro Mountains, New Mexico. Surveyor with Mildon & Russell, Nacozari, Sonora, Mexico, 1910; General engineering work, Hermosillo, Sonora, Mexico, 1911; Mining engineer, Portland, Oregon, 1911; Assistant superintendent, Norton Griffiths Steel Construction Company of London, England, with headquarters at Vancouver, British Columbia, Canada, 1912; Superintendent, same company, with headquarters at Calgary, Alberta, Canada, 1912-1918; E. I. Du Pont De Nemours & Co., 1918-1920—.

JAMES FIELDING BERRY

Pachuca, Hilogdo, Mexico

Student, 1904-1905. From Socorro, New Mexico. Assayer, American Smelting & Refining Company, Aguascalientes, Mexico, 1905; Assayer, City of Mexico, Mexico, 1906-1907; Chemist, Cia Metalurgica y Refinadora del Pacifico, Fundician, Sonora, Mexico, 1918; Assistant mine superintendent, American Smelting & Refining Company, Anganguer, Michiocan, Mexico, 1909-1914; Mine superintendent San Gertrudes Company, Pachuca, Mexico, 1914-1918; Assistant superintendent same company, 1918-1920—.

LOUIS AUGUST BERTRAND

Upland, Nebraska

Student, 1895-1896. From Conway, Iowa. Student, Ecole Professionnelle de l'Est, Nancy, Lorraine, 1890-1894; Instructor in Mathematics and French, New Mexico School of Mines, 1895-1896; Chemist, El Paso Smelting Works, El Paso, Texas; Assayer and surveyor. Consolidated Kansas City Smelting & Refining Company, Chihuahua, Mexico; Superintendent, Carmen Mines, Coahuila, Mexico; Mine superintendent, Cia. Minera de Penoles, Mapimi, Durango, Mexico, 1901-1903.

RALPH C. BLACK

Dillon, Colorado

Entered Academic Class, 1919.

ALEXANDER LOUIS BLACKBURN

Austin, Texas

(B. S. in Metallurgical Engineering, New Mexico School of Mines, Dec. 1918.)

Enlisted in Engineer Enlisted Reserve Corps in Feb., 1918; Student 1915-1918; Mine Surveyor Inspiration Copper Company, Miami, Arizona, 1919; Mine Surveyor, Smuggler Leasing Co., Aspen, Colo., 1919-1920.

RAY LEE BLOOMER

Ragusville, Tenn.

Entered Academic Class, 1920.

CHARLES L. BRADBURY

Richmond, Va.

Entered Freshman Class, 1919.

H. LAWRENCE BROWN

Los Angeles, California

Student, 1903-1905. From Chicago, Illinois. Positions: Assayer, Ernestine Mining Company, Mogollon, New Mexico; Engineer, Cia. Conchenco Beneficiador, Mexico; Mill Superintendent, Milwaukee Gold Extraction Company, Phillipsburg, Montana; Engineer, Transvaal Copper Company, Sonora, Mexico; Manager, Morning Star Mining Company, Ophir, Colorado; Manager, San Carlos Mining Company, Sonora, Mexico; Manager of six properties and consulting engineer, Cobalt, Ontario, Canada; Superintendent, Haile Gold Mine, Kershaw, South Carolina; Exploration work in Venezuela, South America; Mill superintendent, National Mining Company, National, Nevada; at present, general manager engineering department American Metal Company, with headquarters in Foster Building, Denver, Colorado.

S. WALTER BURKE

San Francisco, California

Entered Freshman Class, 1918.

RAYMOND T. BURKE

San Francisco, California

Entered Freshman Class, 1919.

THOMAS BURKE

Socorro, New Mexico

Entered Academic Class, 1919.

W. FRANCIS BUTLER

Frankfort, Kansas

Entered Freshman Class, 1919.

- PHILLIPE A. CAMPREDON** Socorro, New Mexico
(B. S. in Metallurgical Engineering, New Mexico School of Mines, 1914.)
Assayer for Shannon Copper Company, Metcalf, Arizona, 1915-1916;
Postgraduate work Michigan College of Mines, 1916-1917; Chief engineer, Shannon Copper Company, Gleason, Arizona, 1917-1918; Entered U. S. Army in June, 1918; Commissioned Second Lieut. U. S. Engineers; Discharged Dec., 1918. With firm of H. Chambon Estate, Socorro, New Mexico, 1919—.
- JAMES F. CANNON** Roswell, New Mexico
Entered Freshman Class, 1919.
- PETER EDWARD CANNON** Roswell, New Mexico
Student, 1916-1918; Re-entered, 1919.
- *R. HARLAND CASE** Deming, New Mexico
Student, 1902-1905, from Cerrillos, New Mexico. Chemist, Compania Metallurgica de Torreon Coahuila, Mexico, 1905-1906; Assistant superintendent, Bonanza Mines, Zacatecas, Mexico, 1906; Assistant manager, Stephenson-Bennett Mining and Milling Company, Organ, New Mexico, 1906-1907; Consulting engineer, Western Mining, Milling & Leasing Company, Colorado Springs, Colorado, 1907-1908; Mining engineer, Deming, New Mexico.
- KENNETH J. CHAPMAN** Lodi, California
Entered Freshman Class, 1919.
- CARL HARRY CHELLSON** Schenectady, New York
Entered Freshman Class, 1919.
- VIVIAN V. CLARK** Tucson, Arizona
Student, 1896-1898, from Kelly, New Mexico. Assayer, Bland Mining Company, Bland, New Mexico, 1898-1899; Superintendent, Navajo Gold Mining Company, Bland, New Mexico, 1900; Manager, Higuera's Gold Mining Company, Sinaloa, Mexico, 1901; Mine operator, Albuquerque, New Mexico, 1902; Manager Bunker Hill Mining and Smelting Company, Reiter, Washington, 1903-1908; Consulting engineer, Consolidated Exploration Mines Company of New York, and allied syndicates, 1909-1910; President, Northern Engineering Company, Seattle, Washington, 1910-1912; President, Clark Mining Machinery Company, successors to Northern Engineering Company, Seattle, Washington, 1912-1916; Consulting work, Tucson, Arizona, 1916-1920—.
- WILLIAM H. CLUM** Wannatosa, Wisconsin
Entered Freshman Class, 1919.

*Deceased.

DAVID JOSHUE CLOYD

Crown King, Arizona

Student, 1899-1900. From Decatur, Illinois. Chemist and assayer, Wardman's Assay Office, Aguascalientes, Mexico, 1900-1906; Assistant superintendent, Cia. Minera del Tiro General, and assistant superintendent, Cia. del Ferrocarril Central de Potosi, Charcas, San Luis Potosi, Mexico, 1906-1908; Assayer and Chemist, Dailey, Wisner & Company, Torreon, Coahuila, Mexico, 1908; Chief assayer and chemist, Mazapil Copper Company, Saltillo plant, Saltillo, Coahuila, Mexico, 1911-1913; Supt., Bradshaw Reduction Company, Crown King, Ariz.—.

SAMUEL COCKRILL

Indianapolis, Indiana

(B. S., New Mexico School of Mines, 1906.)

Student, 1904-1906. From North Fork, Virginia. Post-graduate engineering course, Allis-Chalmers Company, 1907-1908; Milwaukee Coke and Gas Company, Milwaukee, Wisconsin, 1908-1910; Citizens Gas Company, Indianapolis, Indiana, 1910-1920—.

COURTNEY T. COLLINS

Socorro, New Mexico

Entered Academic Class, 1919.

ROBERT R. COOPER

Pueblo, Colorado

Entered Freshman Class, 1919.

HENRY A. COOK

Arlington, New Jersey

(B. S. in Metallurgical Engineering, New Mexico School of Mines, 1919)

Student, 1916-1919. Principal of Academic Department, New Mexico School of Mines, 1919—.

RICHARD COLLINGS

Denver, Colorado

Entered Short Course, Surveyor, 1920.

CLARENCE L. CRANDALL, JR.

De Beque, Colorado

Entered Freshman Class, 1920.

WILLARD N. DIXON

Santa Fe, New Mexico

Entered Freshman Class, 1919.

FRANK C. DALEY

Pteuty, Sask., Canada

Entered Freshman Class, 1919.

DANIEL DOHERTY

Roxbury, Massachusetts

Entered Short Course. Chemist, Assayer, and Surveyor, 1919.

LEON DOMINION

New York, New York

(B. A., Roberts College, Constantinople, 1896; C. I. M., Mining School University of Liege, 1900.)

Graduate student, 1903-1904. From Constantinople, Turkey. Assistant, United States Geological Survey, 1903; Instructor in Mathematics, New Mexico School of Mines, 1903-1904; Engineer, Victor Fuel & Iron Company, Denver, Colorado, 1904-1906; Superintendent, Bonanza Mine, Zacatecas, Mexico, 1906-1907; Consulting engineer, Mexico City, Mexico, 1908-1909; Consulting engineer, New York City, in care of American Geographic Society, 1910-1920—.

JOHN G. EBERT, JR.

Red Lion, Pennsylvania

Entered Freshman Class, 1918.

ALEXANDER WALTER EDELEN

Mexico City, Mexico

Student, 1905-1906. From Baltimore, Maryland. Assistant superintendent, Elkton Consolidated Mining & Milling Company, Elkton, Colorado, 1906-1907; Superintendent, Bonanza Mine, Zacatecas, Mexico, 1907-1908; Superintendent, American Smelting & Refining Company, Angangueounit, Michiocan, Mexico, 1909-1920—.

WALDEMAR M. ERVIN

Socorro, New Mexico

Entered Special Student, 1919.

WALTER E. ESTES

Boston, Massachusetts

Entered Freshman Class, 1919.

THADDEUS BELL EVERHART

Socorro, New Mexico

Student, 1905-1907. From Bells, Texas. Assayer and surveyor, Pereguina Mining and Milling Company, Guanajueto, Mexico, 1907-1908; Mill superintendent, Las Animas Mining and Milling Company, Pueblo Nuevo, Durango, Mexico, 1908-1910; Mining, Chloride, New Mexico, 1911-1913; Mining engineer, Socorro, New Mexico, 1914-1920—.

SUSAN HAYDEN FITCH

Socorro, New Mexico

Entered Academic Class, 1919.

HANNAH ELIZABETH FITCH

Socorro, New Mexico

Entered Academic Class, 1919.

LEOPOLD E. FLEISSNER

Milwaukee, Wisconsin

(B. S., E. M. in Mining Geology, New Mexico School of Mines, 1912.)

Student, 1910-1912. From Manistee, Michigan. Engineer, Sterling Engineering & Construction Company, Milwaukee, Wisconsin, 1912-1913; Engineer, Ray Consolidated Copper Company, Ray, Arizona. 1913-1917; Blomesinck Company, general contractors, Chicago, Illinois, 1920—.

THOMAS M. GARDNER, JR.

Oakland, California

Entered Academic Class, 1920.

GEE H. GENG

Toledo, Ohio

Entered Freshman Class, 1919.

CARL F. GERTZ

Los Angeles, Calif.

Entered Freshman Class, 1919.

AUGUST S. GEHRELS

Punta Renas, Costa Rico

Entered Freshman Class, 1919.

JOSEPH H. GIRARD

Burnett's Creek, Indiana

Entered Sophomore Class, 1919.

FRANK GOLDBAR

Magdalena, New Mexico

Entered Academic Class, 1919.

EDMUND C. GOLDING

Silver City, New Mexico

Entered Academic Class, 1919.

HARRY THORWALD GOODJOHN

Torreon, Coahuila, Mexico

Student, 1902-1903. From Pittsburg, Texas. Assayer, Cia. Metalurgica de Torreon, Torreon, Coahuila, Mexico, 1903-1906; Chief chemist, Minera de Penoles Company, Mapimi, Durango, Mexico, 1906; Chemist and Metallurgist, Cia. Minera, Fundidora, y Afinadora, Monterey, Mexico, 1907-1908; Chief chemist, Cia. Metalurgica de Torreon, Torreon, Coahuila, Mexico, 1909-1920—.

SAMUEL JAMES GORMLEY

Coquimbo, Chili

Student, 1895-1896. From Mt. Vernon, Iowa. Assistant professor of Engineering, New Mexico School of Mines, 1895-1896; Assistant assayer, Anaconda Copper Mining Company, Anaconda, Montana, 1897-1900; Chemist, same company, 1900-1902; Superintendent of sampling works, Washoe Smelting Company, Anaconda, Montana, 1902-1906; Smelter superintendent, Bingham Copper & Gold Mining Company, West Jordan, Utah, 1906-1916; Manager, Ore Trading Company's Smelter, 1916-1920—.

EDMUND NORRIS HOBART

El Paso, Texas

(B. S., in Mining Engineering and Metallurgical Engineering,
New Mexico School of Mines, 1910.)

Student, 1906-1908; 1909-1910. From Clifton, Arizona. Chemist, Socorro Mines Company, 1909; Chief Sampleman, Shannon Copper Company, Clifton, Arizona, 1910-1911; Assistant surveyor, American Smelting & Refining Company, Anganguero, Michiocoan, Mexico, 1911; Resident engineer, Capistante Mines Group, Mazapil Copper Company, Limited, Concepcion del Oro, Zacatecas, Mexico, 1912; Chief engineer, Charcas Unit, American Smelting & Refining Company, Charcas, San Luis Potosi, Mexico, 1913-1914; Mining engineer, Phelps-Dodge Company, Morenci, Arizona, 1914; Mining engineer, El Paso, Texas, 1915; Assistant State Engineer of New Mexico, 1917-1919; Consulting Mining Engineer, El Paso, Texas, and Mexico City, Mexico, 1920.

JOHN F. HORGAN

Minneapolis, Minnesota

Entered Academic Class, 1919.

CARL JOHN HOMME

Marshfield, Oregon

(A. B., St. Olaf College.)

Graduate student, 1899-1910. From Wittenburg, Wisconsin. Assayer and chemist, Candelaria Mining Company, El Paso, Texas, 1900-1901; Assistant superintendent, Gulf Creek Mining Company, Gulf Creek, New South Wales, Australia, 1902; Assayer, Glendale, Oregon, 1909-1913; Dispatching clerk in postoffice, 1915—.

WILLIAM ELIAS HOMME

Glendale, Oregon

(A. B., St. Olaf College.)

Graduate student, 1902-1903. From Wittenburg, Wisconsin. Assayer, Gulf Creek Mining Company, Gulf Creek, New South Wales, Australia, 1903—.

HAYNES A. HOWELL

El Paso, Texas

Student, 1900-1905. From Socorro, New Mexico. Civil engineer on railway from Acapulco, Mexico, 1906-1907; Civil engineer, Mexican Central R. R., 1907-1912; Assistant to state engineer, Santa Fe, New Mexico, 1913-1917; Reclamation service, El Paso, Texas, 1917-1920—.

JOHN AUGUST HUNTER

Toledo, Ohio

(B. S., New Mexico School of Mines, 1903.)

Student, 1899-1903. From Socorro, New Mexico. Chemist, Consolidated Kansas City Smelting Company, El Paso, Texas, 1903-1904; Chemist and metallurgist, American Smelting & Refining Company, Aguascalientes, Mexico, 1904-1908; Metallurgist, Congress Mining Company, Congress, Arizona, 1909-1910; Assayer, Los Angeles, California, 1910-1911; Engineer, Pioneer Mining Company, Tucson, Arizona, 1911-1912; Engineer, American Zinc Ore Separator Company, Denver, Colorado, 1912-1914; Mining engineer, Socorro, New Mexico, 1914-1915; Engineer for Cananea Copper Company, 1916; Chemist for By-Product Plant, Toledo, Ohio, 1916-1917; Captain, Second U. S. Engineers, A. E. F., 1917-1919; Construction Engineer, Standard Oil Company, Toledo, Ohio, 1919—.

GERALD U. GREEN

Missouri Valley, Iowa

Entered Academic Class, 1920.

WARD F. HAMM

Cleveland, Ohio

Entered Freshman Class, 1919.

HUGH H. HAMMOCK

Mesilla Park, New Mexico

Entered Freshman Class, 1919.

FRANCIS U. HAMMEL

Socorro, New Mexico

Entered Freshman Class, 1919.

EDWIN CLARENCE HAMMEL

Miami, Arizona

(B. S. in Geological Engineering, New Mexico School of Mines, 1917.)

Student, 1914-1917. Sergeant, U. S. Engineers, 1917-1918; Engineering Dept Inspiration Copper Company, 1919-1920—.

ROBERT W. HARMEN

Tazewell, Virginia

Entered Short Course—Chemist, Assayer, and Surveyor, 1919.

WILLIAM O. HEACOCK

Albuquerque, New Mexico

Entered Short Course—Highway Engineering, 1919.

CHARLES M. HENDREN

Rock Island, Illinois

Entered Freshman Class, 1919.

BEULAH HERRICK

Socorro, New Mexico

Entered Special Student, 1919.

SARAH HERRICK

Socorro, New Mexico

Entered Special Student, 1919.

- DOROTHY ARDIS HILL** Socorro, New Mexico
Entered Freshman Class, 1919.
- CLARENCE HOFFER** Arlington, New Jersey
Entered Freshman Class, 1919.
- PABLO INGUNZA** Lima, Peru, S. A.
Entered Freshman Class, 1917—.
- FRANK A. JOHNSTON** New Bloomfield, Pennsylvania
Entered, 1911, from New Bloomfield, Pennsylvania. Secured B. S. degree in Civil Engineering, 1913.
- RALPH WALDO JOHNSTON** Whitinsville, Massachusetts
Entered Freshman Class, 1919.
- LEON WILLIAM KELLY** Montrose, Pennsylvania
(B. S. in Mining Engineering, New Mexico School of Mines, 1917.)
Student, 1915-1917. Research department, International Smelter Company, Tooele, Utah, 1917; Second Lieut., U. S. Infantry, 1917-18; Research department, International Smelter Company, Tooele, Utah, 1919; Engineer, U. S. Fuel Company, Mohrland, Utah, 1919; Engineer, Utah Fuel Company, Castlegate, Utah, 1920—.
- ELLIOTT G. KEMPTON** Newton Upper Falls, Massachusetts
Entered Academic Class, 1919.
- JOHN L. KLEINER** Hurley, New Mexico
Entered Freshman Class, 1919.
- JOHN P. KENNEDY, JR.** Natchez, Mississippi
Entered Sophomore Class, 1919.
- LAWRENCE J. KING** Philadelphia, Pennsylvania
Entered Academic Class, 1919.
- FREDERICK KRUG** Jersey City, New Jersey
Student, 1917-1918. Assistant electrician, New York and Honduras Rosaria Mining Company, 1917-18; Instructor Air Service School, Carnegie Institute of Technology, Pittsburgh, Pa, 1918-1919; Electrician, New York and Honduras Rosaria Mining Company, Honduras, C. A., 1919—.
- FAY G. LECKLIDER** Toledo, Ohio
Entered Short Course—Highway Engineering, 1919.
- EDWARD LEVINE** Brooklyn, New York
Entered Freshman Class, 1919.
- PABLO LLAGUNO Y DE CARDENAS** Tinor del Rue, Cuba
Entered Special Student, 1919.

CHARLES THAYER LINCOLN

New York, New York

(B. S., Massachusetts Institute of Technology, 1901.)

Graduate student, 1902-1903. From Boston, Massachusetts. Chemist, Bell Telephone Company, 1901-1902; Assistant in Analytical Chemistry, New Mexico School of Mines, 1902-1903; Acting professor, same, 1903-1904; Instructor in Chemistry, Iowa State University, Iowa City, Iowa, 1904-1905; Chemist, Hartford Laboratory Company, Hartford, Connecticut, 1905-1907; Chemist, Arbuckle Brothers Sugar Refinery, Brooklyn, New York, 1907-1909; Chemist, United States Custom Service, New York, 1910-1920—.

FRANCIS CHURCH LINCOLN

Reno, Nevada

(B. S., Massachusetts Institute of Technology; E. M., New Mexico School of Mines, 1903.)

Assayer, San Bernardino Mining Company, 1900; Chemist, Butterfly Terrible Gold Mining Company, 1900-1901; Professor of Metallurgy, New Mexico School of Mines, 1902-1904; Assistant Superintendent, Ruby Gold & Copper Company, Ortiz, Sonora, Mexico, 1904; General manager, Arizona Gold & Copper Company, Patagonia, Arizona, 1904; Professor of Geology, Montana School of Mines, Butte, Montana, 1907-1910; Consulting engineer, New York City, 1910-1911; Assistant professor of Mining, University of Illinois, Urbana, Illinois, 1911-1913; Resident engineer, Bolivian Dev. & Exp. Co., La Paz, Bolivia, 1913-1914; Director Mackay School of Mines, University of Nevada, 1914-1920—.

HORACE T. LYONS

Ajo, Arizona

(B. S. in Mining Engineering, New Mexico School of Mines, 1913.)

Mining Engineer at Miami, Arizona, 1913-1914; First Lieut. Field Artillery Quartermaster's Corps, 1917-1919; Real Estate Business, Ajo, Arizona, 1919—.

HARRY C. MAGOON

Chicago, Illinois

Student, 1899-1900. From Chicago, Illinois. Engineer, Illinois Steel Company, Chicago, Illinois, 1911-1920—.

FRANK MALOIT

Hanover, New Mexico

(B. S. in Mining Engineering, New Mexico School of Mines, 1914.)

Mining engineer at Lordsburg, 1914-1915; Acting superintendent, Hanover mine, The Empire Zinc Company, 1918-1920—.

HARRY R. MANEE

Magdalena, New Mexico

Entered Academic Class, 1919.

HUGO MAREK, JR.

Socorro, New Mexico

Student, 1916-1918. Re-entered, 1919.

LESTER C. MARSH

Independence, Missouri

Entered Freshman Class, 1919.

LAURENCE E. MARSCHAT Ashley Falls, Massachusetts
Entered Freshman Class, 1919.

LEON MASON Toledo, Iowa
Entered Freshman Class, 1919.

STANLEY MAYER Socorro, New Mexico
Entered Freshman Class, 1919.

DANIEL M. MILLER Lake Valley, New Mexico
(B. S., New Mexico School of Mines, 1909.)
Chemist, Lake Valley Mines Company, Lake Valley, New Mexico;
Topographic engineer, U. S. Army—.

RAYMOND V. MILLER Socorro, New Mexico
Entered Freshman Class, 1919.

LOUISE E. MILLER Socorro, New Mexico
Entered Special Student, 1919.

ROY MITCHELL Grinnel, Iowa
Entered Freshman Class, 1919.

THOMAS A. MONOGHAN Plainville, Massachusetts
Entered Freshman Class, 1919.

TARVER MONTGOMERY Santa Ana, California
Student, 1899-1900. From Santa Ana, California. County surveyor,
Orange county, California, 1900-1901; Assistant engineer, Temescal
Water Company, Corona, California, 1901; Transitman, San Pedro, Los
Angeles & Salt Lake Railroad Company, 1901-1902; Assistant engineer,
Pacific Electric Railroad Company, Santa Ana, California, 1902—.

WILLIAM ESTILL MOORE Bowling Green, Kentucky
Student, 1915-1917; Lieutenant, U. S. Aviation Service, A. E. F., 1917-
1919; Petroleum Geologist, Bowling Green, Kentucky, 1919—.

EARLE GIBBON MORGAN Guadalajara, Jalisco, Mexico
(E. M., New Mexico School of Mines, 1911.)
Student, 1907-1908, 1910-1911. From Landsdowne, Pennsylvania.
Pennsylvania State College, 1908-1910; Engineer, Socorro Mines Com-
pany, Mogollon, New Mexico, 1911-1912; Assistant engineer, same com-
pany, Guadalajara, Jalisco, Mexico, 1912—.

ERLE D. MORTON Mammoth, Arizona
(E. M. in Mining Geology, New Mexico School of Mines, 1909.)

Student, 1903-1905, 1908-1909. From Los Angeles, California. Assist-
ant superintendent, Giroux Consolidated Mines Company, Kimberly,
Nevada, 1905-1906; Washington University, 1906-1907; Mine examiner,
Los Angeles, California, 1907-1908; Surveyor, Ampara Mining Com-
pany, Etzatlan, Jalisco, Mexico, 1908; Mine superintendent, Arizona &
Nevada Copper Company, Luning, Nevada, 1909-1910; Mining engineer,
Los Angeles, California, 1910; Chief engineer, Lone Mountain Tunnel

Company, Superior, Montana, 1911-1912; with Braun Corporation, Los Angeles, California, 1912-1913; Assistant superintendent, Elko-Prince Mining, Gold Circle, Elko County, Nevada; Assistant superintendent Mammoth mine, Mammoth, Arizona, 1916-1920—.

WILLIAM FREDERICK MURRAY

Gallup, New Mexico

Student, 1904-1906. From Raton, New Mexico. In chief engineer's office, Victor Fuel Company, Denver, 1906-1907; Assistant engineer, Victor Fuel Company, 1907-1908; Assistant to chief and traveling engineer, Victor Fuel Company and Colorado & Southern Railway Company, 1908; Assistant engineer, Hastings Mine, Victor Fuel Company, Hastings, Colorado, 1909-1910; Superintendent, Cass Mine, Victor-American Fuel Company, Delagua, Colorado, 1910-1913; Assistant general superintendent, Victor-American Fuel Company, Gallup, New Mexico, 1913-1920—.

JAMES N. McDOUGAL

Deming, New Mexico

Entered Academic Class, 1920.

ROY SYLVESTER McVEIGH

Kelly, New Mexico

Student, 1917-1918. Re-entered, 1919.

JOHN A. McKINNON

Silver City, New Mexico

Entered Freshman Class, 1916.

JOHN G. McNULTY

New York, New York

Entered Freshman Class, 1919.

ELLSWORTH H. NEWTON

Franklin, New Hampshire

Entered Freshman Class, 1918.

MARTIN J. O'BOYLE

Mogollon, New Mexico

(B. S. in Mining Engineering, New Mexico School of Mines, 1914.)

Mining engineer for the Socorro Mines Company, Mogollon, New Mexico, 1914-1919—.

WILLIAM L. O'BRIEN

Oakland, California

Entered Freshman Class, 1919.

JOSEPH F. O'HARA

Santa Rita, New Mexico

Entered Short Course—Highway Engineering, 1920.

MRS. A. M. OCKERBLAD

Socorro, New Mexico

Entered Special Student, 1919.

ORESTE PERAGALLO

Tepec, Mexico

(E. M., New Mexico School of Mines, 1918.)

Student, 1907-1908. From Ciudad Juarez, Chihuahua, Mexico. Mining engineer, El Paso, Texas, 1908-1910; Graduate student, New Mexico School of Mines, 1910-1911; Mining engineer, El Paso, Texas, 1911-1912; Chemist, Tepec, Mexico, 1912-1914; Mining engineer, San Diego, California, 1915-1918.

N. P. PETERSON

Owatonna, Minnesota

Student, 1916-1920; B. S. in Metallurgical Engineering, May, 1920—

JAMES W. PRICE

Sams, Colorado

Entered Short Course—Chemist, Assayer, and Surveyor, 1919.

WILLIAM F. RHYNE

Chico, Texas

Entered Academic Class, 1920.

ALBERT BRONSON RICHMOND

Tucson, Arizona

Student, 1900-1901. From Las Prietas, Sonora, Mexico. Superintendent, Ramona Mill Company, Gabilan, Sonora, Mexico, 1901-1902; Assayer, Patagonia Sampling Works, Patagonia, Arizona, 1902; Assayer and metallurgist, Patagonia, Arizona; General manager, Mansfield Mining & Smelting Company, Patagonia, Arizona, 1908; Consulting engineer, Tucson, Arizona, 1909; Field engineer, Mines Company of America, with headquarters at Tucson, Arizona, 1910-1920—.

DELL FRANK RIDDELL

Parral, Chihuahua, Mexico

(Ph. C., Chicago College of Pharmacy, 1896; B. S., Nebraska State University, 1901; E. M., New Mexico School of Mines, 1905.)

Graduate student, 1903-1905. From Sioux Falls, South Dakota. Professor of Chemistry, Sioux Falls College, Sioux Falls, South Dakota, 1901-1903; Instructor in Chemistry, New Mexico School of Mines, 1903-1904; Acting professor of assaying, same, 1904-1905; Holder of Allis-Chalmers Scholarship, 1905-1906; Engineer, Universal Pump & Manufacturing Company, Kansas City, Missouri, 1906-1907; Superintendent, Benito Juarez Mine, Parral, Chihuahua, Mexico, 1907-1908; Consulting engineer and acting superintendent, Providentia Mines Company, Parral, Chihuahua, Mexico, 1908-1916; Mine superintendent, Ajo, Arizona, 1916-1920—.

SOREN RINGLUND

Socorro, New Mexico

(B. S. and E. M. in Mining Geology, New Mexico School of Mines, 1912.)

Student, 1910-1912. From Ceresco, Nebraska. Engineer, The Empire Zinc Company, Kelly, New Mexico, 1912-1914; Mining geologist, The Empire Zinc Company, 1915-1918; Enlisted Medical Corps, U. S. Army, July 1, 1918; Died July 24, 1918.

ORLANDO DOUGLAS ROBBINS

Depue, Illinois

(B. S. and E. M., New Mexico School of Mines, 1909.)

Student, 1905-1909. From Louisville, Kentucky. Chemist, El Chino Copper Company, Santa Rita, New Mexico, 1909-1910; Mill superintendent, Germania Mining Company, Springdale, Washington, 1910; Chief sampler, Inspiration Copper Company, Globe, Arizona, 1910; Engineer, United States Steel Company, Depue, Illinois, 1911-1913; Chief of ore and testing department of Mineral Point Zinc Company, Depue, Illinois, 1914-1920—.

CECIL ROWE

Arden, Nevada

Entered Freshman Class, 1917.

- JULIUS SANCHEZ** Socorro, New Mexico
(B. S. in Geological Engineering, New Mexico School of Mines, 1917.)
Student, 1912-1914, 1915-1917. Lieutenant, Signal Reserve Corps, U. S. Aviation Service, 1917-1919; Field geologist, Socorro Petroleum Company, Socorro, New Mexico, 1919—.
- MANUEL A. SANCHEZ** Mora, New Mexico
(B. S. in Civil Engineering, New Mexico School of Mines, 1917.)
Student, 1914-1917. United States Geological Survey, 1917-1919; Chief State Hydrographer of New Mexico, 1919-1920—.
- EDGAR J. SAUER** Kankakee, Illinois
Entered Short Course, Oil Geology, 1919.
- CHARLES S. SHAMEL** Seattle, Washington
(B. S., M. S., University of Illinois; LL. B., University of Michigan; A. M., Ph. D., Columbia University.)
Graduate student, 1901-1902. Mining lawyer, Seattle, Washington.
- ROBERT O. SHEPARD** San Diego, California
Entered Freshman Class, 1919.
- ACIL C. SHIPPS** Springfield, Illinois
Entered Freshman Class, 1919.
- THOMAS SIMPSON** Leadville, Colorado
Entered Short Course—Chemist, Assayer, and Surveyor, 1919.
- HOWARD A. SISSON** Tacoma, Washington
Entered Freshman Class, 1919.
- JAMES AVERY SMITH** Smuggler, Colorado
Entered, 1908, from Socorro, New Mexico. B. S. Degree in Metallurgical Engineering, 1913; Assayer and sampler, Inspiration Copper Company, Miami, Arizona, 1913-1916; on oil flotation, Smuggler Union Mine, Telluride, Colorado, 1916; Oil flotation engineer in California and at Clifton, Arizona, 1916-1917; Sergeant, Company C, Eighteenth Regiment, U. S. R. R. Engineers, A. E. F., 1917-1919; Flotation Engineer, General Engineering Company, Tomboy Mine, Smuggler, Colorado, 1919.
- OLIVER RUSSELL SMITH** Naches, Washington
(B. S., Kansas College of Agriculture and Mechanic Arts, 1908; C. E., New Mexico School of Mines, 1902.)
Graduate student, 1898-1901. From Manhattan, Kansas. B. S. in Civil Engineering, New Mexico School of Mines, 1902; Assistant in Mathematics and Draughting, New Mexico School of Mines, 1900-1901; Instructor in Engineering and Drawing, same, 1901-1902; Assistant professor in Engineering and Drawing, same, 1902-1903; Assistant surveyor, U. S. General Land Office, 1902; City engineer, Socorro, New Mexico, 1902; Deputy mineral surveyor, U. S. General Land Office, 1903; Professor of Civil Engineering, New Mexico School of Mines.

1903-1907; Civil engineer, Santa Fe Railway, San Bernardino, California, 1907-1908; Engineer United States Reclamation Service, Zillah, Washington, 1908-1920—.

RAYMOND E. SPEARE

Socorro, New Mexico

Entered Freshman Class, 1919.

HOWARD STECH

Rushville, Indiana

Student, 1917-1920; B. S. in Metallurgical Engineering, 1920—.

PAUL E. M. STEIN

El Paso, Texas

(B. S., New Mexico School of Mines, 1911; E. M. in Mining Geology, 1912.)

Student, 1907-1912. From Davenport, Iowa. Assistant engineer, Socorro Mines Company, Mogollon, New Mexico, 1912; Chemist, El Paso plant, Kansas City Consolidated Smelting and Mining Company, El Paso, Texas, 1912-1917; Assistant superintendent, 1917-1920—.

KARL AKSEL STRAND

Hanover, New Mexico

(B. S. and E. M. in Mining Geology, New Mexico School of Mines, 1912.)

Student, 1906-1912. From Socorro, New Mexico. Ore classifier, Utah Copper Company, Garfield, Utah, 1912; Draughtsman, same, 1912-1913; Mine superintendent, The Empire Zinc Company, Hanover, New Mexico, 1914-1920—.

ALLIE STROZZI

Magdalena, New Mexico

Entered Academic Class, 1919.

WALTER D. SMILEY

Socorro, New Mexico

Entered Freshman Class, 1919.

LEO RICHARD AUGUST SUPPAN

St. Louis, Missouri

(B. S. in Chemistry and Metallurgy, New Mexico School of Mines, 1896.)

Student, 1895-1896. From St. Louis, Missouri. Instructor in Chemistry, New Mexico School of Mines, 1895-1897; Graduate student, Johns Hopkins University, Baltimore, Maryland, 1897; University of Warburg, Germany, 1898; Professor of Chemistry, Marine-Sims College, St. Louis, Missouri, 1898; Associate professor of Pharmaceutical Chemistry, St. Louis, College of Pharmacy, 1913—.

FREDERICK A. TEMPLE

Huntington, West Virginia

Entered Short Course—Chemist, Assayer, and Surveyor, 1919.

JERRY THOMAS

New Boston, Texas

Entered Freshman Class, 1919.

FELIPE TORRES

Socorro, New Mexico

Entered Academic Class, 1919.

OTTO JOSEPH TUSCHKA Monterey, Neuvo Leon, Mexico
(E. M. in Metallurgical Engineering, New Mexico School of Mines, 1897.)

Student, 1893-1897. From Socorro, New Mexico. Assayer and chemist, Graphic Smelting Works, Magdalena, New Mexico, 1897-1898; Graduate student, New Mexico School of Mines, 1898-1899; Assistant sampling mill foreman and chemist, Guggenheim Smelting & Refining Company, Monterey and Aguascalientes, Mexico, 1899-1900; Assayer, Seamon Assay Laboratory, El Paso, Texas, 1900; Chief chemist, Compania Minera, Fundidora, y Afinadora, "Monterey," Monterey, Nuevo Leon, Mexico, 1900-1916; Engineer, Old Dominion Copper Company, 1916-1920.

LAURENCE P. WELD Thompson, Nevada
(B. S. and E. M., New Mexico School of Mines, 1912.)

Student, 1908-1912. From Rochester, New York. Concentrator man, Original Amador Mines Company, Amador City, California, 1912-1913; Assistant engineer and chemist, same company, 1913; Smelter electrician, Mason Valley Mines Company, Thompson, Nevada, 1913—.

MILTON BENHAM WESTCOTT Monterey, Nuevo Leon, Mexico
Student, 1904-1905. From Chicago, Illinois. Engineering corps, Santa Fe Railway, 1905; Assistant county surveyor, El Paso county, Texas, 1906-1907; Assistant engineer, Monterey Railway, Light and Power Company, Monterey, Nuevo Leon, Mexico, 1907; Assistant engineer, Monterey, Water-works and Sewer Company, Monterey, Nuevo Leon, Mexico, 1907-1908; Resident engineer, same, 1908-1913; Construction engineer, Nelson, B. C., 1913-1920—.

CHARLES F. WILLIAMS Mansfield, Ohio
Student, 1914-1915. Entered Junior Class, 1919.

WAKELEY A. WILLIAMS Grand Forks, British Columbia, Canada
Student, 1893-1894. From Council Bluffs, Iowa. Assistant superintendent, Granby Consolidated Mining, Smelting and Power Company, Limited, Grand Forks, British Columbia, Canada, 1898. At present superintendent of same.

VERNON WINNINGHAM Porterville, California
Entered Freshman Class, 1919.

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NEW MEXICO
STATE
SCHOOL OF MINES

SOCORRO, N. M.



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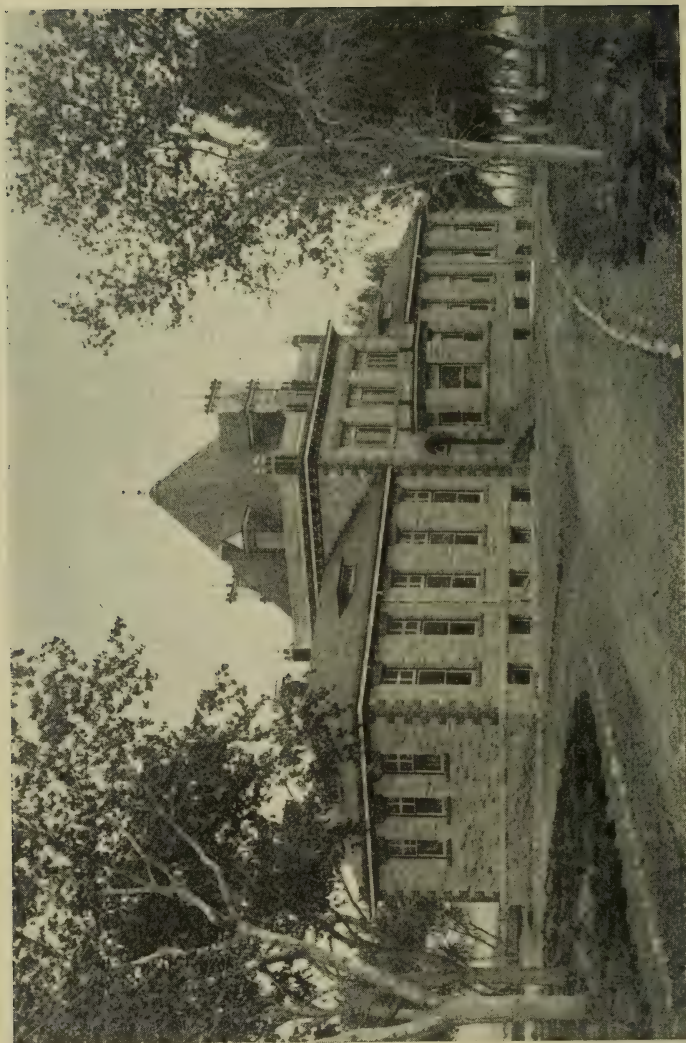


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MAIN BUILDING

SCHOOL CALENDAR

1921

First Semester:

September 6, Tuesday—Registration of students.

September 7, Wednesday—Class work begins.

September 26—"M" Day.

November 11—Armistice Day.

November 24, 25, 26—Thanksgiving Recess.

December 22, Thursday, 4 p. m.—Holiday recess begins.

1921

January 2, Monday—Work resumed.

January 9, 10, 11, 12, 13—Examinations.

Second Semester:

January 16, Monday—Registration.

January 17, Tuesday—Class work begins.

February 22, Washington's Birthday—Holiday.

May 11, 12, 15, 16, 17—Final Examinations.

May 18—Commencement.

BOARD OF REGENTS

C. T. BROWN, <i>The Empire Zinc Company</i>	Socorro
J. M. SULLY, <i>General Manager Chino Copper Co.</i>	Hurley
CORA E. MOFFETT.....	Socorro
B. H. KINNEY, <i>Manager Kinney Coal Mine</i>	Tokay
E. M. SAWYER, <i>Manager Phelps Dodge Corporation</i>	Tyrone

The complete board is as follows:

HIS EXCELLENCY, M. C. MECHEM, <i>Governor of New Mexico, ex-officio</i>	Santa Fe
HON. J. V. CONWAY, <i>Superintendent of Public Instruction, ex-officio</i>	Santa Fe
C. T. BROWN	Socorro
J. M. SULLY.....	Hurley
CORA E. MOFFETT.....	Socorro
B. H. KINNEY.....	Tokay
E. M. SAWYER.....	Tyrone

OFFICERS OF THE BOARD

C. T. BROWN	President
CORA E. MOFFETT.....	Secretary and Treasurer
BLANCHE REED	Clerk

FACULTY

ALEXIS XAVIER ILLINSKI....*President and Professor of Chemistry*

B. S. in Chemistry and Metallurgy, School of Mines and Metallurgy, University of Missouri, 1909; Met. E., School of Mines and Metallurgy, University of Missouri, 1916; Superintendent of Underground Diamond Drills, Federal Lead Company, Flat River, Missouri, 1906-7; Superintendent of Canvas Plant, Federal Lead Company, Flat River, Missouri, 1907-08; Chemist, Missouri Geological Survey, Rolla, Missouri, 1909-12; Instructor in Metallurgy and Ore Dressing, School of Mines and Metallurgy, Rolla, Missouri, 1912-14; Experimental Research Station, School of Mines and Metallurgy, Rolla, Missouri, 1914-15; Professor of Chemistry, New Mexico State School of Mines, 1915-17; President and Professor of Chemistry, New Mexico State School of Mines, 1917—

EDGAR HERBERT WELLS.....*Professor of Geology and Mineralogy*

E. M. University of North Dakota, 1900; Assistant Engineer, Daly West Mine, Park City, Utah, 1909; Mining and leasing operations, Daly West and Daly-Judge Mines, Park City, Utah, 1910-11; Engineer and Draftsman, Canadian Collieries (Dunsmuir), Ltd., Cumberland, B. C., 1912-14; Instructor in Mathematics, Geology, Mineralogy and Physical Education, Tintic Mining High School, Eureka, Utah, 1914-16; Instructor in Mathematics and Physical Education, West Side High School, Salt Lake City, Utah, 1916-1917; Assistant Superintendent, Austin-Dakota Mining Co., Austin, Nevada, 1917; Professor of Geology and Mineralogy, New Mexico State School of Mines, 1917—

RICHARD HERB REECE.....*Professor of Mathematics and Physics*

B. S. in Electrical Engineering, Kansas State Agricultural College, 1906; Graduate student at University of Wisconsin, 1916; M. So. Mathematics and Physics, University of Colorado; Telephone Engineer with Western Electric Co., Chicago, 1906-08; Principal of High School, Champion, Mich., 1908-10; Instructor in Mathematics, Michigan Agricultural College, 1910-17; Professor of Mathematics and Physics at the New Mexico State School of Mines, 1917—; Member of the Mathematical Association of America.

BYRON JOHN SNYDER.....*Professor of Mining and Metallurgy*

B. S. in Chemistry and Metallurgy, School of Mines and Metallurgy, University of Missouri, 1907; Met. E. School of Mines and Metallurgy, University of Missouri, 1910; Assistant in Chemistry, Missouri School of Mines and Metallurgy, 1904-06; Instructor in Chemistry, Missouri School of Mines and Metallurgy, 1907-08; Chemist Research and Analytical Laboratory, Mallinckrodt Chemical Works, St. Louis, Mo., 1908-10; Director of Mining Department and Professor of Mining Engineering and Metallurgy, North Georgia Agricultural College, University of Georgia, 1910-17; Professor of Mining and Metallurgical Engineering, New Mexico State School of Mines, 1917—

ANDREW MERRITT OCKERBLAD.....*Professor of Civil Engineering*

B. S. in Civil Engineering, University of Vermont, 1910; Instructor in Civil Engineering, Michigan Agricultural College, 1910-13; Examiner of Surveys U. S. Forest Service, Washington, D. C., 1913-17; Civil Engineer in charge of department for the Wichita Mapping and Engineering Company, Wichita, Kansas, 1917; Instructor in Civil Engineering, Throop College of Technology, 1917; First Lieutenant Engineers, U. S. A., 1917-19; Civil Engineer U. S. Naval Ordnance Plant, South Charleston, W. Va., 1919; Professor of Civil Engineering, New Mexico School of Mines, 1919—

WALLACE DUNCAN REYNOLDS....*Professor of English and Spanish*

Colegio Internacional, 1910; Ph. B., Meridian College, 1912; M. Ped. Meridian College, 1913; A. M. University of Little Rock, 1915; Instructor in Spanish, Meridian College, 1910-13; Professor of Languages, Laredo Seminary, 1913-14; Professor of Latin and Spanish, Nebraska State Normal School, 1916-18; Professor of English and Spanish, New Mexico School of Mines, 1919—

MATT FOWLER.....*Lecturer in Mining Law*

LL. B. Grant University, 1905; LL. B. University of Illinois, 1907. Member of Bar of Illinois, Tennessee, New Mexico and Federal Courts.

GEORGE MORRISON WILLIAMSON.....

.....*Assistant Professor of Civil Engineering*

Cornell University, 1914; M. E. Certificate in Electrical Engineering, A. S. C. E.; Engineer and Construction Superintendent Interborough Rapid Transit Company, 1914-17; First Lieutenant Engineers, U. S. A. Light Railway Const., 1917-19; Resident Engineer American Woolen Company, Boston, Mass., and Lockwood, Green & Co., Engineers and Architects, New York City, 1919; New Mexico State School of Mines, 1921—

JOSEPH MICHAEL O'LOUGHLIN

.....*Principal Academic Department, Director of Athletics*

B. Lit., Los Gatos Normal College, California, 1914; A. B. Woodstock College of Georgetown University, 1916; M. A. Woodstock College of Georgetown University, 1917; Professor of Pre-Medical Biology, Athletics, Sacred Heart College, Denver, Colo., 1917-18; Principal of High School, Athletics, Magdalena, N. M., 1919-20; Principal Academic Department, Director of Athletics, New Mexico School of Mines, 1920—

BLANCHE REED*Registrar*

ORGANIZATION

The New Mexico State School of Mines includes the College of Engineering and the Academy.

COLLEGE OF ENGINEERING

In the College of Engineering the following courses are offered:

- I. Mining Engineering.
- II. Metallurgical Engineering.
- III. Geological Engineering.
- IV. Civil Engineering.
- V. General Science.

THE ACADEMY

The Academy offers instruction in certain subjects required for entrance to the College of Engineering.

NEW MEXICO STATE SCHOOL OF MINES

HISTORICAL SKETCH

The New Mexico State School of Mines was founded by Act of the Legislature of 1889. The Act provided for the support of the School by an annual tax of one-fifth of a mill on all taxable property.

Under an Act of the Legislature, approved February 28, 1891, a board of trustees was appointed. Organization was effected and immediate steps were taken towards the erection of necessary buildings. In the same year a special appropriation of \$4,000 was made for the partial equipment of the chemical and metallurgical laboratories.

Early in 1892 a circular of information regarding the New Mexico State School of Mines at Socorro, New Mexico, was issued by the Board of Trustees. In this circular the aims of the institution were fully set forth. The following year a president was chosen and classes in chemistry were admitted but it was not until the autumn of 1895 that the mining school was really opened.

In 1893 a second special appropriation of \$31,420 was made to enable the School of Mines to be organized in accordance with the policy outlined by the Act creating the institution.

By Act of Congress, approved June 21, 1895, the New Mexico State School of Mines received for its share of certain grants of land fifty thousand acres for its support and maintenance.

In 1899 the Legislature increased the former levy of one-fifth of a mill to twenty-seven and one-half one-hundredths of a mill.

In 1901 the Thirty-fourth General Assembly recognized the growing importance of the School by further increasing the tax levy to thirty-three one-hundredths of a mill. It also authorized the bonding of any portion of the grants of land in order to more thoroughly equip the School with buildings and apparatus.

In 1903 the Thirty-fifth General Assembly raised the millage to forty-five one-hundredths of a mill. This, with greatly in-

creased assessed valuation of property, doubled the income of the school over that of the previous year.

Since 1903 the appropriation for the support and maintenance of the School of Mines has been increased at each session of the General Assembly. At the first session of the State Legislature the appropriation was raised to \$22,500 a year.

The Second State Legislature in 1915 provided the additional fund of \$20,000 for machinery and metallurgical and ore dressing equipment.

By the terms of the Enabling Act under which New Mexico was admitted to statehood, the School of Mines becomes possessed of an additional 150,000 acres of land. Most of this land has now been selected and will soon become the source of a very considerable revenue to the institution.

STATUTES RELATING TO THE SCHOOL

Some of the sections of the Act creating the School of Mines are as follows:

The object of the School of Mines created, established and located by this Act is to furnish facilities for the education of such persons as may desire to receive instruction in chemistry, metallurgy, mineralogy, geology, mining, milling, engineering, mathematics, mechanics, drawing, the fundamental laws of the United States and the rights and duties of citizenship, and such other courses of study, not including agricultural, as may be prescribed by the Board of Trustees.

The management and control of said School of Mines, the care and preservation of all property of which it shall become possessed, the erection and construction of all buildings necessary for its use, and the disbursement and expenditure of all moneys appropriated by this Act, or which shall otherwise come into its possession, shall be vested in a board of five regents, who shall be qualified voters and owners of real estate; and said regents shall possess the same qualifications, shall be appointed in the same way, and their terms of office shall be the same, vacancies shall be filled in like manner, as is provided in sections 9 and 10 of this Act. Said regents and their successors in office shall constitute a body under the name and style of "The Board of Regents of the New Mexico State School of Mines," with right as such of suing and being sued, of contracting and being contracted with, of making and using a common seal and altering the same at pleasure, and of causing all things to be done necessary to carry out the provisions of this Act. A majority of

the board shall constitute a quorum for the transaction of business, but a less number may adjourn from time to time.

The board of regents shall have power to confer such degrees and grant such diplomas as are usually conferred and granted by other similar schools.

The regents shall have power to remove any officer, tutor, instructor or employe connected with said School when, in their judgment, the best interests of said School require it.

The board of regents shall require such compensation for all assays, analyses, mill-tests, or other services performed by said institution as they may deem reasonable, and the same shall be collected and paid into the treasury of the School of Mines for said institution, and an accurate account thereof shall be kept in a book provided for that purpose.

LOCATION

The New Mexico State School of Mines is located at Socorro, the county seat of Socorro County, on the main line of the Atchison, Topeka and Santa Fe Railway, 75 miles south of Albuquerque, and 180 miles north of El Paso. The Magdalena branch of the Santa Fe railway starts from this place.

Socorro is situated in the valley of the Rio Grande at the foot of the Socorro range of mountains at an elevation of 4,600 feet above the level of the sea. The surrounding scenery is diversified by plains, valleys, mesas, hills, and mountains. The climate of the locality is preeminently pleasant and healthful, and has long attracted health-seekers who would escape the rigors of less favored localities. The air is exceedingly dry and the temperature is mild and equable. Socorro's public water supply comes from warm springs that issue from Socorro mountain three miles away. The water is famed for its purity and has always been an attraction to visitors and residents.

The ground immediately adjacent to the School of Mines includes irrigable land, plateaus and mountains, all affording an excellent field for practice in surveying, the laying out of railroads and irrigating canals, topography, mine engineering and geology, so that students can be prepared at the very door of the school in those branches which usually require tedious excursions from many schools.

The New Mexico State School of Mines enjoys the natural advantage of being located in the midst of a region peculiarly rich in minerals of nearly all kinds, and is within easy reach of the most varied geological conditions, all of which are within a

radius of thirty or forty miles of Socorro. The industrial processes connected with mining and metallurgy may be seen admirably illustrated at Mogollon, Kelly, White Oaks, San Pedro, Hillsboro, Lordsburg, Fierro, Silver City, Pinos Altos, Santa Rita, Burro mountains, Hurley, El Paso, Los Cerrillos, Dawson, Gallup, Carthage, and elsewhere within easy reach of the School. These illustrate the most modern methods of mining, milling, ore-dressing, concentrating, lixivation, cyaniding, and other metallurgical processes.

A number of mines of various kinds, smelters, irrigation systems, and other engineering works are accessible to the School. Within a few hours ride by rail are many important mining camps. The longer excursions bring the student to some of the most famous mines in southwestern United States. Some of the oldest worked lodes in America are in this region. Gold and turquoise were first noted by the *conquistadores* in 1540-2 by the celebrated expedition of Francisco Vasquez de Coronado, when in search of the Gran Quivera, one of the seven cities of Cibola. The first modern discovery of gold west of the Mississippi was made in New Mexico at the base of the Ortiz mountains, in Santa Fe county, in the year 1828. The first copper mined west of the Mississippi river was at Santa Rita in Grant County, in 1800. The metal from these copper mines was transported on the backs of burros to Mexico City and thence sent to the royal mint of Spain to be made into coin. The Chino Copper Company now operates these celebrated mines. Among the great wonders of the West are the ancient turquoise workings at Mount Chalchihuitl, near Los Cerrillos. An ancient lode mine, known as Mina del Tierra, is situated near the ancient turquoise workings.

The history of modern mining schools shows that each becomes most celebrated along the line for which its locality is best known on account of its natural surroundings. Few institutions of learning are more dependent for success upon what may be called the accident of geographical location. It may be truthfully said that few mining schools are more fortunately situated so far as natural environment is concerned than that of the New Mexico State School of Mines.

BUILDINGS AND GROUNDS

The Campus

The State School of Mines campus contains 32 acres of nearly level ground on the outskirts of the city of Socorro.

Main Building

The main building consists of three stories and a good basement. It is T-shaped, 135 feet long by 100 feet deep, the central rear wing being 54x32 feet. It is constructed in a very substantial manner of a beautiful gray granite in broken ashler and is trimmed with Arizona red sandstone.

The building is handsomely finished throughout. It is well ventilated, steam-heated, piped for water and gas, and wired for electricity for illumination and for experimental purposes.

As now arranged the main floor of this building contains the president's office, the mineralogical museum, the qualitative chemical laboratory and instructor's office. The basement contains two lecture rooms, the physical laboratory, and instructor's private mineralogical laboratory, the quantitative chemical laboratory, the electro-chemical laboratory, an instructor's private chemical laboratory, the chemical supply rooms, the steam heating plant, and the lavatory. A lecture room, now occupied by the department of mathematics, is located on the second floor. The main library occupies the third floor.

Mining, Engineering and Metallurgy Building

The engineering building is north of the main building and is constructed in the form of a Greek cross, sixty by one hundred twenty feet, twenty-four feet high. This structure is built of steel and concrete; the roof being concrete, the sash steel and the doors three-ply tin. The roof trusses are of steel monitor type, carried on steel columns. The monitor is about ten feet wide and has a three-foot top-hung steel sash along both sides. This sash serves to ventilate the building, being operated from the floor by an endless chain pulley and worm gear. The arrangement of the windows and sash is such that the most remote corner is thoroughly illuminated.

This structure is employed at present to house the Mining and

Metallurgy as well as the Civil Engineering department. The central part of the building is used for an Assay Laboratory, Ore Dressing Plant and Experimental Flotation Plant. The north wing of the structure is used for lecture rooms and office of the Mining and Metallurgy Department. The Civil Engineering Department occupies the south wing of the building.

Power Plant

The power plant building is constructed of reinforced concrete. The building is 34 feet long, 24 feet wide and 18 feet high. It is well lighted by 14 windows, each 4x6 feet, having heavy reinforced glass. The structure is absolutely fire-proof. The building is one of the most attractive structures on the grounds.

Dormitory

The School of Mines has an excellent dormitory. The building is heated with steam and lighted with electricity. There is a dining room and a kitchen in connection, also a bath room on each of the two floors and a shower bath in the basement. On the main floor is located the boys' club room.

LABORATORIES AND EQUIPMENT

Chemical Laboratories

The chemical laboratories as now arranged occupy the entire south wing of the main building, while the store room, private laboratory, and chemical lecture room are located in the central section of the same building. Elements of chemistry and qualitative analysis are taught in the large laboratory on the main floor. The room, which is exceptionally well lighted and ventilated, is equipped with large hoods, a balance room, and twenty-four desks, each of which is supplied with gas, water, and electric light.

The basement laboratory is fitted with large windows, glass partitions, and modern desks. The east half of it is used for quantitative analysis and wet assaying. There are large hoods in each end, which are supplied with hot plates and drying ovens, while each desk is supplied with an Alberine stone sink, water, gas, and electric lights.

In the west half of the basement there are the instructor's laboratory, electro-chemical laboratory, and balance room. The latter is fully equipped with the best analytical balances supported upon a solid concrete table, which is entirely free from vibration. The electro-chemical laboratory is supplied with current from a modern storage battery plant, consisting of a motor-generator, storage cells, and a switch-board so arranged that each student may obtain any current he desires for analytical or other electro-chemical experiments. There is also a supply of alternating current from the city circuit which may be used for light and for the small electric furnaces, in case of an accident to the School of Mines plant.

The laboratory is very completely equipped not only with all apparatus, chemicals, and supplies needed for the various courses, but the stock includes a large amount of pure chemicals and special apparatus, including standardized burettes, flasks, and weights which are used for the most accurate rock analysis and research work.

All apparatus is loaned to the students. Chemicals and supplies are furnished at cost.

Assay Laboratory

The assay laboratory occupies the main floor of the metallurgy building. The furnaces are all new and include muffle gasoline blow-pipe furnaces of different types and large muffle coal and coke furnaces. This department is conveniently arranged with shelving, drawers and boxing for fluxes, and other assaying materials and supplies.

A weighing room containing a number of Becker's balances is conveniently located between the furnace-room and the lecture-room. In the grinding room there are various types of laboratory machines for carrying on experimental work.

Physical Laboratory

The physical laboratory occupies the east side of the north basement of the main building and contains the usual apparatus for illustrating the facts and laws of physics. In addition there is the apparatus necessary to perform the quantitative experiments outlined in Courses 201, 202 and 203 in the Department of Physics.

Petrographical Laboratory

For the microscopic study of rocks the School has a good collection of thin sections of various igneous, sedimentary, and metamorphic rocks, accompanied by hand specimens, giving the student an opportunity to study both the microscopic and megascopic characteristics. The laboratory is equipped with standard up-to-date microscopes, with all accessories, and a Sauveur and Boylston polishing machine for making thin sections and preparing polished surfaces of opaque minerals and mineral aggregates.

Mineralogical Laboratory

The School is provided with an abundant supply of ores and minerals for blow-pipe determinations and for the study of minerals by their physical characteristics. Several collections designed for this work have been recently secured. The laboratory is equipped with the necessary apparatus to carry on the work in an efficient manner.

Mineralogical Museum

The mineralogical museum, with instructor's office, occupies the north wing of the first floor of the main building. The

School of Mines owns an excellent collection of minerals, ores, and rocks. The mineral specimens from some of the mining districts are segregated, thereby giving the student the best possible opportunity of studying the minerals of these districts without having actually visited them. New specimens are being added from time to time.

Electrical Equipment

The equipment of the power plant consists of two semi-Diesel Fairbanks-Morse Company engines. The smaller of the two engines delivers about 15 horsepower at full load, and is belted to an air compressor and also a direct current dynamo. The compressor is used to store air in two cylindrical reservoirs at a pressure of 120 pounds per square inch for starting the larger engine. The fuel oil used by these engines may be any crude heavy oil or distillate. The larger engine is controlled by an inertia governor on the main shaft and varies the supply of oil according to the speed. The cylinder is lubricated by forced feed. The larger of these two engines is intended to furnish most of the power on the campus. It is of the vertical type and runs with very little vibration. The top of the cylinder is about eight feet above the base of the engine. The fly-wheel is about seven feet in diameter and weighs nearly five tons. It is mounted between the vertical engine and the alternating current generator which furnishes power to the various buildings. The alternating current generator gives a 3-phase current, so that either 3-phase or single phase motors may be used in the various buildings. The larger engine and alternator will deliver 37.5 kilowatts at 440 volts when run at 257 revolutions per minute. The current is about 47 amperes per phase at full speed. The field coils of the alternator are excited by means of a generator, which is run from the main shaft of the larger engine. The generator can deliver 40 amperes and 125 volts when run at 1250 revolutions per minute. The direct current dynamo connected with the smaller engine will deliver 60 amperes at 125 volts when run at 1250 revolutions per minute. The frequency of the alternating current at the rated speed of the larger engine is 60 cycles per second.

There are two switchboards, one for the alternating current power circuits and one for the direct current power circuits. The former was designed and constructed by the Westinghouse Electric Company, and the latter by the General Electric Company. The former contains three panels; an exciter panel, a generator

panel, and a feeder panel. There are thirteen ammeters and volt-meters mounted on these panels, together with a three-phase watt meter. Oil switches are used in the main alternating current circuit and in the various feeding lines, which run to the 3-phase and single phase meters. It is possible to see at a glance the amount of current that is being used on these branches and the total amount of power that is being used on all the motors.

The voltage of each phase can also be measured. Current transformers are used in connection with the 3-phase watt meter. There are the usual arrangements for detecting grounds. The switch board also provides for the installation of an additional similar power unit to run in synchronism with the present unit.

EXPERIMENTAL FLOTATION PLANT

The Chino Copper Company, of Hurley, New Mexico, of which Mr. John M. Sully is general manager, has generously donated to the New Mexico School of Mines a complete two-ton experimental flotation plant.

This equipment makes it possible to carry on experiments on sufficiently large portions of ore to make the student's work of great practical value to him.

This experimental plant is housed in the main room of the Mining and Metallurgical building.

Engineering Instruments

The School has purchased and has on hand for student use sufficient equipment to make such surveys as are required in ordinary practice of engineering. This naturally embraces a complete assortment of transits, levels, plane tables, planimeters, as well as rods, tapes and other accessories. This collection is constantly growing and equipment that cannot be repaired and used is discarded and new equipment added.

Draughting Room

A spacious, well-lighted draughting-room is provided in the mechanical building. Opening off from it are the instructor's office, supply-room, blue-print room, with large printing frame, developing-vat, and drying rack.

A drawing table is furnished each student. There are private spaces for his materials and instruments. An Ingersoll-Rand drill and other pieces of machinery are used as models.

Libraries

The libraries of the New Mexico School of Mines consist of a general library and department libraries.

In the main library are the encyclopedias, dictionaries, journals, magazines, proceedings of the learned societies, periodical issues of other colleges, reports of federal, state and foreign surveys, official maps, plats, and atlases.

The following periodicals and publications are received by the School:

Engineering and Mining Journal.

Mining and Scientific Press.

Power.

Engineering News Record.

Chemical and Metallurgical Journal.

Journal of the American Chemical Society.

Journal of Industrial and Engineering Chemistry.

Electrical World.

Chemical Abstracts.

Economic Geology.

Journal of Geology.

Transactions of the American Institute of Mining Engineers.

All the U. S. Geological Survey Publications.

U. S. Bureau of Mines Publication.

Canadian Geological Survey Publications.

Various daily and weekly papers.

Libraries are located in the several departments of the School. These are essentially working libraries. They consist of carefully chosen treatises, text-books, monographs, and special contributions pertaining to the respective divisions.

Powell Library.—The School has come into possession of the private library of the late Major John W. Powell of Washington, D. C., who for many years was director of the United States Geological Survey. The collection consists of works on mining, geology, philosophy and many rare monographs of great practical value. Especially well represented is the literature relating to the Rocky Mountain region and the great Southwest. It was in these fields that Major Powell did most of his work which has had such an important influence on the development of the mining industry. It therefore seems particularly fitting that the library of this famous man, who has been so long identified with this western country, should find a permanent home in New Mexico.

Socorro Mountain Mines

The silver mines at the base of Socorro Mountain, only about two miles west of the School campus, afford excellent opportunity for the practice of mine-surveying and for a study of some features of practical mining. The ore-bodies with associated geological structures and many other features will interest the student of mining and geological engineering.

Purpose

The ideal to which the New Mexico School of Mines tenaciously holds is the practical directing of young men to take active part in the development of the mineral wealth of the world.

The School is a state institution, established primarily to promote the development of the mineral resources of New Mexico and to provide facilities for the young men of the state to secure a practical education in all departments of mining. The institution's field of usefulness has steadily grown broader, through its graduates, not only in New Mexico, but also in other parts of the Southwest, in the development of the mining industries of this great region. Moreover, a considerable number of students from other parts of the country who desired to avail themselves of the peculiar advantages of this region have come to the School of Mines for the training they needed.

During the entire period of his training the fact is impressed upon the mind of the student that mining is a business capable of being put on as secure a foundation as any other; that from beginning to end it is akin to all other great business undertakings.

Advantages

Several features contribute to the success of this institution as a school of mines:

The unique natural surroundings of the School already described create an invigorating mining atmosphere which is entirely wanting in institutions remote from the mines and mountains.

In the training offered by the School there is noteworthy concentration of effort. There are many advantages in specialization along few lines. In contrast with the many diversions that necessarily exist in those technical institutions of learning where all practical branches are equally represented, singleness of

purpose is a leading feature of the New Mexico State School of mines. The concentration of energy growing out of the special method of instruction happily adapts the student so that he gets the most out of his labors.

The student is expected as an integral part of his course to visit and critically inspect, under the direct supervision of his instructors, various plants and works and to make intelligent reports. Being obliged from the start to make the most of the exceptional opportunities presented, he quickly falls into the spirit of his present and future work and at once necessarily acquires for his chosen profession a sympathy that is seldom attained, except after school days are over and after long and strenuous effort.

Being within short distances of mines and smelters, the student has the opportunity of finding regular employment during his vacation and of acquiring desirable experience in practical work.

The field for scientific research in New Mexico is unrivalled and the opportunities here offered are not neglected in the plan and scope of instruction.

Much of the advanced professional work of the School is of an original nature to the end that the graduates may be skilled, theoretically and practically, in the very problems which they as professional men will be called upon to solve. This work is carried on by the advanced students under the direction of the professors and involves the collection of notes, sketches, maps, and specimens, and the results of directed observation in all matters relating to the sciences and arts embraced in the courses of study. The subjects for such researches in geology and mining in the reduction of the ores of lead, silver, gold, copper, and zinc are so numerous that it is impossible to do more here than to mention the fact that the conditions of climate, drainage, water-supply, and geological structure in New Mexico differ greatly from the conditions existing in other parts of the Rocky Mountains, thus giving rise to new problems in practice. These problems are not by any means all that deserve attention. The investigations of the ores of iron, manganese, aluminum, cobalt, nickel, tin, quicksilver, vanadium and uranium, together with the beds of coal, salt, alum, building stones, mineral-paints, cement-rock, marls, etc., are directly in line with the advanced laboratory work of the School. Work of this character on the part of the students is encouraged in every possible way.

ADMINISTRATION

The general management of the New Mexico State School of Mines is vested in a Board of Regents consisting of five members appointed, for a term of four years, by the governor of the state with the concurrence of the senate. The board of regents elects a president from its members and also a secretary, and treasurer. The appointment of a president and other members of the faculty and teaching staff is made by them.

By an act of the legislature, the maintenance of a preparatory department is required. The New Mexico State School of Mines, therefore, is composed of the College and the Academy.

THE COLLEGE OF ENGINEERING

ADMISSION

Applicants for admission to the College should arrange to be present the first day of the school year. In 1921 the College opens September 6th and students will register on that day.

Admission by Certificate

Graduates of approved high schools of this and other states or of other schools offering equivalent training will be admitted to the regular four-year courses without examination, provided their certificate of graduation shows that they have included in their preparatory work at least one unit of algebra, one unit of plane geometry, one-half unit of solid geometry, and one unit of either elementary physics, chemistry or general science.

If applicant is deficient in one or two of the subjects specified above he may be admitted conditionally. The Academy offers opportunity for the removal of such conditions and all students thus admitted will be expected to remove their conditions during their freshman year.

Admission by Examination

Candidates for admission who cannot show a certificate of graduation from an approved preparatory school will be required to stand examination in one unit of algebra, one unit of plane geometry, one-half unit of solid geometry, one unit in either elementary physics, chemistry, or general science, and eight and one-half units of elective subjects. The results of these examinations will be presented to the faculty and with their consent the applicant may enter the school. All students admitted by this method will be expected during their first semester to show that they are capable of pursuing with success work of college character.

Admission on Advanced Standing

Students desiring to enter this college on credits from other institutions should present a copy of their credits, together with letter of honorable dismissal, to the President of the College. This College is willing to give credit for work done in other rec-

ognized institutions in so far as it applies upon our courses of study. The amount of credit given for any subject is determined by the department in which similar work is offered.

Soldier Specials

To men not regularly or formerly prepared for college and who, as a result of their war experiences, aspire to advanced training, there is offered the opportunity of entrance into the college work without examination or certificate. The subsequent advancement of this class of students to regular standing is a matter of faculty decision. To those who do not desire or obtain regular standing there will be furnished a certificate indicating the work accomplished.

Mature Students

At the discretion of the faculty, students who are twenty-one years of age or older, and particularly those who have had considerable practical experience along some technical line, will be permitted to enter the freshman class. After entrance the student must acquire credit in elementary physics, elementary algebra, plane and solid geometry, and a good working knowledge of English.

Credit Hours

The amount of credit allowed for the various subjects is expressed in credit hours. A credit hour is given to one lecture period a week or three laboratory periods a week for one semester. For instance, Course 202 requires three lecture periods and three laboratory periods a week and receives four credit hours.

Regulations Concerning Prerequisites

No student will be allowed to register for a subject without having previously completed the prerequisites except on the recommendation of the instructor and with the approval of the faculty. College credit will not be granted for any subject until the prerequisites have been passed satisfactorily.

Registration

Students shall be required to register for subjects before being admitted to classes, even though college credit is not desired. Changes in registration must be made through the of-

fice of the registrar. Any course discontinued without permission of the faculty will be recorded as a failure. Students will not be permitted to take work totaling more than twenty-four credit hours or less than twelve credit hours without the consent of the faculty.

DEGREES

This institution confers two classes of degrees: First, the Bachelor of Science degree at the completion of one of the prescribed four-year courses; and, second, the degree of Engineer of Mines, Metallurgical Engineer, Geological Engineer, or Civil Engineer upon compliance with certain additional requirements.

The degree of Bachelor of Science in Mining Engineering, Metallurgical Engineering, Geological Engineering, Civil Engineering or General Science is conferred upon those who, as students of the institution, have completed the corresponding prescribed courses of any one of the several curricula. This degree is also conferred upon those who, as students of this institution, have completed the courses which represent one full year's work in any of the several curricula and have given satisfactory evidence of having previously completed the other courses of that curriculum. Work done at other colleges for a degree may be accepted so far as it corresponds to the work done here, but in each case the faculty reserves the right to decide whether the previous work has been satisfactory. A candidate for the Bachelor's degree must announce his candidacy at the beginning of the school year at whose termination he expects to receive the degree. This announcement must be in writing and must specify both the curriculum and the degree sought.

The degree of Engineer of Mines, Metallurgical Engineer, Geological Engineer, or Civil Engineer, will be conferred upon a graduate of this school who has completed the corresponding undergraduate course; who has done at least two years of successful professional work along that line subsequent to receiving the Bachelor's degree, during one of which he has held a position of responsibility; and who has presented an original and acceptable thesis. The appropriate Engineer's degree will also be granted to a graduate of this school who has fulfilled the above scholastic and thesis requirements and who has had at least five years of professional experience along technical lines during one of which he has occupied a position of responsibility.

A candidate for the Engineer's degree should make application for the same on or before January first of the school year in

which the degree is to be granted. He should at the same time submit the subject of his thesis, which must be approved by the faculty. Each thesis must be typewritten on paper eight and one-half by eleven inches, and must be submitted not later than March first. If it is found to be satisfactory the advanced degree will be granted on Commencement day at the end of the school year. A corrected copy of the thesis must be delivered to the president at least two weeks prior to the granting of the degree. It is expected that the thesis in each case shall be prepared with care and shall exhibit sufficient evidence of independent investigation to warrant its publication at the discretion of the faculty.

All degrees are conferred by the board of regents upon the recommendation of the faculty.

CURRICULA

- I. Mining Engineering.
- II. Metallurgical Engineering.
- III. Geological Engineering.
- IV. Civil Engineering.
- V. General Science.

UNIFORM CURRICULUM FOR THE FIRST TWO YEARS OF COURSES I, II, III AND IV

The curriculum for the first and second years of courses I, II, III and IV, offered at the School of Mines is the same in all respects. This arrangement is of advantage to the student, as it gives him until the beginning of the third year to determine for which of the four courses he is best fitted by inclination or aptitude.

Mathematics, physics, and chemistry are fundamental subjects for the successful engineer. For that reason the first two years of all the engineering courses are devoted to a thorough grounding in those three subjects, as will be seen in the tabular statement below. Specialization does not begin until the third year.

UNIFORM CURRICULUM. FRESHMAN YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
101	Algebra	3	
103	Trigonometry	3	
301	General Chemistry	5	6
401	Mechanical Drawing		6
801	English	3	
805	Spanish (elective)*	3	
	Second Semester		
104	Analytic Geometry	4	
302	General Chemistry	2	
304	Qualitative Analysis	2	9
402	Descriptive Geometry	1	3
406	General Surveying	2	4
802	English	3	
806	Spanish (elective)*	3	

*Students taking Course V who do not intend to elect Calculus 105 and 106, must elect Spanish 805 and 806 in the Freshman year.

**UNIFORM CURRICULUM.
SOPHOMORE YEAR.**

Course Number	Courses	Periods a week	
		Class	Lab'y
First Semester			
105	Calculus	3	
201	Physics	3	3
305	Quantitative Analysis	1	6
407	Mine Surveying and Mapping.....	1	4
501	General Geology	3	
509	Mineralogy	2	3
807	Spanish (elective)	2	
Second Semester			
106	Calculus	3	
202	Physics	3	3
306	Quantitative Analysis	1	6
408	Topographic Surveying	2	4
502	General Geology	2	1
510	Mineralogy	3	3
808	Spanish (elective)	2	

I. MINING ENGINEERING

As one of the chief purposes of the School is to prepare men to become designers of mining plants and supervisors of mining operations, the strictly business careers of the profession are kept constantly before the student. Valuing property, properly reporting propositions submitted for investment, calculating the factors in the economical operation of a plant and suggesting the best methods of developing a property, are considerations which receive careful treatment and are given prominence during the latter part of the curriculum.

Especially are the similarities and departures between the operations and requirements of metal-mining and coal-mining brought out. Placer and hydraulic mining and dredging, and the recent adaptation of the steam shovel and stripping methods to western metal mines are treated at considerable length.

Another important feature which is continually being more and more considered in mining operations is the geology of mineral deposits, and this subject receives detailed consideration.

JUNIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
203	Direct and Alternating Currents.....	5	3
403	Machine Drawing		3
503	Economic Geology	2	
511	Petrology	1	3
601	Principles of Mining.....	2	
609	Fuel and Boiler Water Analysis.....		4
701	Fire Assaying	1	
703	Principles of Metallurgy	3	
	Second Semester		
412	Mechanics	5	
504	Economic Geology	3	
512	Petrology	1	3
602	Principles of Mining	2	
610	Mining Law	2	
702	Fire Assaying		6
704	Principles, Metallurgy of Iron and Steel	3	

SENIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
First Semester			
419	Masonry Construction	2	
423	Strength of Materials	3	
425	Hydraulics	2	
507	Field Geology	1	8
603	Ore Dressing	2	3
605	Mine Examination		3
607	Mine Administration and Accounts....	1	
705	Metallurgy of Non-Ferrous Metals....	3	
803	English	2	
Second Semester			
404	Machine Design		3
420	Pumping	2	
422	Heat Power Engineering.....	3	
506	Ore Deposits	2	
604	Ore Dressing	2	
608	Design of Mine Plant.....		3
706	Metallurgy of Non-Ferrous Metals....	3	
708	Metallurgical Laboratory	1	6
804	English	2	

II. METALLURGICAL ENGINEERING

The aim of this four years' course is to train the student for a professional career in any branch of metallurgical work. Attention is given during the first two years to such fundamental subjects as mathematics, chemistry, physics, geology, mineralogy, and preliminary courses in engineering. Instruction in metallurgy proper begins in the third year, both lectures and laboratory experiments being employed for the purpose. Chemistry and geology are provided for, also. The work of the fourth year is along the line of advanced courses in metallurgy; especial attention being given to laboratory experiments, high temperature conditions of metallurgy, training in execution and interpretation of results. Such higher branches of engineering, chemistry, and courses of importance in mining engineering claim a considerable share of attention.

The course has been chosen with special reference to giving the student in metallurgical engineering a general knowledge of modern metallurgy as a whole, and a special knowledge of the metallurgy of each of the more important metals.

Freshman and Sophomore years. See pages 27 and 28.

JUNIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
203	Direct and Alternating Currents.....	5	3
309	Metallurgical Analysis		3
403	Machine Drawing		3
503	Economic Geology	2	
601	Principles of Mining	2	
701	Fire Assaying	1	
703	Principles of Metallurgy	3	
	Second Semester		
308	Electro-Analysis		6
412	Mechanics	5	
504	Economic Geology	3	
602	Principles of Mining	2	
610	Mining Law	2	
702	Fire Assaying		6
704	Principles, Metallurgy of Iron and Steel	3	

SENIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
First Semester			
423	Strength of Materials.....	3	
425	Hydraulics	2	
603	Ore Dressing	2	2
607	Mine Administration and Accounts....	1	
705	Metallurgy of the Non-Ferrous Metals	3	
709	Metallurgical Calculations	1	
711	Metallurgical Plant Design.....		6
713	Metallography	1	3
803	English	2	
Second Semester			
310	Physical and Theoretical Chemistry..	2	
404	Machine Design		3
506	Ore Deposits	2	
604	Ore Dressing	2	
706	Metallurgy of Non-Ferrous Metals.....	3	
708	Metallurgical Laboratory		6
712	Metallurgical Plant Design.....		6
714	Electro-Metallurgy	2	
804	English	2	

III. GEOLOGICAL ENGINEERING

This course is intended primarily to give the training necessary in order to follow successfully any of the usual branches of geological work. It also prepares the student to examine and report correctly on prospects and mining properties, and to direct underground prospecting and development work. Attention is given to the geology of oil and gas and the examination of possible oil-bearing areas.

In the first two years a thorough training is given in such fundamental subjects as mathematics, physics, chemistry, surveying, and English. Geology and mineralogy are included in the second year's work and are followed by petrology and economic geology in the third year, and field geology, ore deposits, paleontology, and oil and gas geology in the fourth year. Accompanying these subjects in the last two years are courses in assaying, advanced electricity, mechanics, hydraulics, metallurgy, ore-dressing, principles of mining and mine examination.

JUNIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
First Semester			
203	Direct and Alternating Currents.....	5	3
503	Economic Geology	2	
515	Petrology	1	6
601	Principles of Mining	2	
701	Fire Assaying	1	
703	Principles of Metallurgy.....	3	
Second Semester			
412	Mechanics	5	
504	Economic Geology	3	
516	Petrology	1	6
602	Principles of Mining	2	
610	Mining Law	2	
702	Fire Assaying		6
704	Principles, Metallurgy of Iron and Steel	5	

SENIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
425	Hydraulics	2	
505	Oil and Gas Geology.....	2	
507	Field Geology	1	8
513	Paleontology	2	3
603	Ore Dressing	2	3
605	Mine Examination		3
705	Metallurgy of the Non-Ferrous Metals	3	
803	English	2	
	Second Semester		
508	Applied Geology	2	8
514	Ore Deposits	5	
604	Ore Dressing	2	
608	Design of Mine Plant.....		3
706	Metallurgy of the Non-Ferrous Metals	3	
804	English	2	

IV. CIVIL ENGINEERING

This department provides a course of study in the theory and application of the principles of civil engineering. The first two years of work are the same as in the other engineering courses, including practical work in drafting room and field, as well as instruction in the fundamental principles of mathematics and physics. In the third year the studies relate more directly to civil engineering. Technical courses cover the principles of structural and machine design, power and power transmission, and other fundamental engineering processes. In the drafting room the student applies those principles to the design of machines, and the bridge and roof trusses. Sufficient field work is given to make the student thoroughly familiar with surveying instruments, and their use in road, mine, and railroad surveys. The proper care and adjustment of surveying and engineering instruments are made prominent in the training of the civil engineer.

Freshman and Sophomore years. See pages 27 and 28.

JUNIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
203	Direct and Alternating Currents.....	5	3
403	Machine Drawing		3
413	Roads and Pavements.....	2	3
415	Theory of Structure.....	3	3
417	Materials of Construction.....	3	
703	Principles, Metallurgy of Iron and Steel	3	
	Second Semester		
410	Railroad Surveying	2	6
412	Mechanics	5	
414	Railroad Engineering	3	
416	Cement Testing		6
610	Mining Law	2	
704	Principles, Metallurgy of Iron and Steel	5	

SENIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
409	Irrigation and Drainage.....	2	3
419	Masonry Construction	2	
421	Contracts and Specifications.....	2	
423	Strength of Materials	3	
425	Hydraulics	2	
427	Hydraulic Engineering		3
429	Cost Keeping and Management.....	1	
431	Reinforced Concrete	2	3
803	English	2	
	Second Semester		
420	Pumping	2	
422	Heat Power Engineering.....	3	
424	Bridge Design	2	3
426	Structural Design	3	3
428	Municipal and Sanitary Engineering..	2	3
430	Water Supply Engineering.....	3	3
804	English	2	

V. GENERAL SCIENCE

This course is not designed to prepare students for any special branch of engineering, but rather to provide a broad general training along scientific lines. A total of 140 credit hours, approximately one-third of which are elective, are required for graduation. Credit must be obtained in both semesters of a two-semester subject in order that credit be counted for graduation. The student is thus given an opportunity to specialize in some branch, according to his inclination.

Freshman year is the same as for Courses I, II, III and IV.

SOPHOMORE YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
201	Physics	3	3
305	Quantitative Analysis	1	6
407	Mine Surveying and Mapping.....	1	4
501	General Geology	3	
509	Mineralogy	2	3
	One of the following subjects must be Elected:		
807	Spanish	2	
105	Calculus	3	
	Second Semester		
202	Physics	3	3
306	Quantitative Analysis	1	6
408	Topographic Surveying	2	4
502	General Geology	2	1
510	Mineralogy	3	3
	One of the following subjects must be elected:		
808	Spanish	2	
106	Calculus	3	

JUNIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
203	Direct and Alternating Currents.....	5	3
403	Machine Drawing		3
601	Principles of Mining	2	
701	Fire Assaying	1	
703	Principles of Metallurgy	3	
	A minimum of three (3) credits to be selected from the following:		
307	Advanced Chemistry		8
413	Roads and Pavements.....	2	3
415	Theory of Structures.....	3	3
417	Materials of Construction	3	
503	Economic Geology	2	
511	Petrology	1	3
809	Spanish	3	
	Second Semester		
308	Electro-Analysis		6
602	Principles of Mining	2	
610	Mining Law	2	
702	Fire Assaying		6
704	Principles, Metallurgy of Iron and Steel	3	
	A minimum of three (3) credits to be selected from the following:		
410	Railroad Surveying	2	6
412	Mechanics	5	
414	Railway Engineering	3	
416	Cement Testing		6
504	Economic Geology	3	
512	Petrology	1	3
810	Spanish	3	

SENIOR YEAR.

Course Number	Courses	Periods a week	
		Class	Lab'y
	First Semester		
803	English Elections may be made from the fol- lowing:	2	
409	Irrigation and Drainage.....	2	3
419	Masonry Construction	2	
421	Contracts and Specifications.....	2	
423	Strength of Materials	3	
425	Hydraulics	2	
431	Reinforced Concrete	2	3
505	Oil Geology	2	
507	Field Geology	1	8
513	Paleontology	2	3
603	Ore Dressing	2	3
605	Mine Examination		3
607	Mine Administration and Accounts...	1	
705	Metallurgy of the Non-Ferrous Metals	3	
709	Metallurgical Calculations	1	
711	Metallurgical Plant Design.....		6
713	Metallography	1	3
	Second Semester		
804	English Elections may be made from the fol- lowing:	2	
301	Physical and Theoretical Chemistry..	2	
428	Municipal and Sanitary Engineering..	2	3
430	Water Supply Engineering	3	3
508	Applied Geology	2	8
506	Ore Deposits	2	
604	Ore Dressing	2	
608	Design of Mine Plant		3
706	Metallurgy of Non-Ferrous Metals....	3	
708	Metallurgical Laboratory	1	6
714	Electro-Metallurgy	2	

DEPARTMENT OF MATHEMATICS

PROFESSOR REECE.

The following is a brief description of the several courses, regularly offered, in the Department of Mathematics:

101. College Algebra.

Required in I, II, III, IV and V.

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, three periods a week.

Review of fundamental principles; variables and functions; theory of exponents, including logarithms; graphs; equalities, inequalities; ratio, proportion and variation; mathematical induction; binominal theorem; progressions; complex numbers; undetermined coefficients; partial fractions; permutations and combinations; probabilities.

103. Trigonometry.

Required in I, II, III, IV and V.

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, three periods a week.

The trigonometric functions are defined as ratios; proofs of the principal formulas used in the solution of both the plane and spherical triangles; trigonometric transformations; circular measure of angles; solutions of trigonometric equations; inverse trigonometric functions; solution of right and oblique triangles, plane and spherical, with and without the use of logarithms.

104. Analytic Geometry.

Required in I, II, III, IV and V.

Prerequisites: Courses 101 and 103.

Time: Freshman year, second semester.

Lectures, four periods a week.

Systems of co-ordinates; graphical representation of functions; transformation of co-ordinates; graphs of trigonometric and transcendental functions; the straight line; circle; parabola; ellipse; hyperbola; empirical equations; space co-

ordinates; space curves; surfaces; limits; introduction to the calculus.

105. Calculus.

Required in I, II, III and IV.

Prerequisites: Course 104.

Time: Sophomore year, first semester.

Lectures, three periods a week.

Limits; derivatives; geometrical and physical interpretations of the derivative; successive differentiation; differentiation of transcendental functions; elementary applications to physics and geometry; maxima and minima of functions; differentials; rates; integration, with simple applications to problems in physics and geometry.

106. Calculus.

Required in I, II, III and IV.

Prerequisites: Course 105.

Time: Sophomore year, second semester.

Lectures, three periods a week.

This is a continuation of Course 105 and treats of curvature; asymptotes; partial derivatives; formal integration; use of integral tables; integration as a summation process; successive integration; series; application of definite integrals, including double and triple integrals, to geometry and mechanics.

DEPARTMENT OF PHYSICS

PROFESSOR REECE.

The following is a detailed description of the several courses in the Department of Physics:

201. Physics.

Required in I, II, III, IV and V.

Prerequisites: Courses 101 and 103.

Time: Sophomore year, first semester.

Lectures, three periods a week.

Laboratory, three periods a week.

The subject includes the mechanics of solids, liquids and gases; heat, with introduction to thermodynamics.

A laboratory course accompanies and supplements the lectures. It is quantitative in character, and involves measurements and determinations of the principal quantities in physics. The following experiments are performed: Equilibrium of forces; composition of forces; accelerated motion; relation of force to mass and acceleration; moments; theory of weighing; impact of elastic and inelastic bodies; Young's modulus; co-efficient of rigidity; simple harmonic motion; measurement of gravitation constant; moment of inertia; center of gravity; co-efficient of expansion; calorimetry; Boyle's law; Archimedes' principle; and others if time permits.

202. Physics.

Required in I, II, III, IV and V.

Prerequisites: Course 201.

Time: Sophomore year, second semester.

Lectures, three periods a week.

Laboratory, three periods a week.

This course is a continuation of Course 201, and includes the subjects of electricity and magnetism; light; sound. Particular stress is placed upon the magnetic, heating and chemical effects of the electric current; on the distribution of current and potential, in both series and parallel circuits; upon the laws of reflection and interference of waves, and the theory of optical instruments.

Parallel with the lecture course is the laboratory course. The experiments include: determination of pitch and composition of sounds, length of sound waves; velocity of sound; diffraction and interference of light; photometry; refraction; spectrum analysis; measurements of current; resistance; electromotive forces; capacities; inductances.

203. Direct and Alternating Currents.

Required in I, II, III, IV and V.

Prerequisites: Courses 104 and 202.

Time: Junior year, first semester.

Lectures, five periods a week.

Laboratory, three periods a week.

Discussions and laboratory work on electric circuits and resistance, magnetic circuits, electro-magnets, Ohm's law, measurement of resistance and power in electric circuits, direct current generators and motors; starters and controllers; storage batteries, the practical operation of generators and motors; inductance, capacity, reactance, impedance, power factor, alternators, induction motors, transformers, electric illumination, practical operation of machines.

DEPARTMENT OF CHEMISTRY

PROFESSOR ILLINSKI.

301. General Chemistry.

Required in I, II, III, IV and V.

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, five periods a week.

Laboratory, six periods a week.

This course is introductory to the engineering courses and is required of all students. The fundamental principles of the science are taught in connection with the descriptive chemistry of the more important non-metals. The lectures are designed to precede the work of the laboratory, in which the student is expected to illustrate and verify the facts and principles which have been discussed in the lectures. Careful manipulation, thoroughness in observation, accuracy in arriving at conclusions, and neatness in note-taking are required of each student.

No previous study of chemistry is required for admission to this course, but the laboratory instruction is so arranged that students who have already spent considerable time upon chemical work in the secondary school are permitted to conduct experiments of a somewhat advanced character, in which the knowledge they have already acquired is utilized.

302. General Chemistry.

Required in I, II, III, IV and V.

Prerequisites: Course 301.

Time: Freshman year, second semester.

Lectures, two periods a week.

Continuation of Course 301. Devoted to the chemistry of the metals, with particular attention being paid to the reactions employed in analytical chemistry, in metallurgy, and in geology. The knowledge of the laws and theories previously acquired is applied to practical examples as they arise.

304. Qualitative Analysis.

Required in I, II, III, IV and V.

Prerequisites: Course 301, accompanied by Course 302.

Time: Freshman year, second semester.

Lectures, two periods a week.

Laboratory, nine periods a week.

The lectures include a thorough grounding in the principles upon which are based the qualitative separations and the identification of the commoner elements. In the laboratory the student is given practical instruction in manipulation that he may best apply the knowledge gained in the lectures. He is gradually led through the more simple separations to the analysis of alloys, minerals, rocks, slags, and mattes. A neat, systematic notebook containing the method of separation used, the reasoning involved in its selection, the confirmatory tests, and all the equations involved, is an essential part of this course.

305. Quantitative Analysis.

Required in I, II, III, IV and V.

Prerequisites: Course 304.

Time: Sophomore year, first semester.

Lecture, one period a week.

Laboratory, six periods a week.

A course embodying the general principles of quantitative analysis and introductory to those involving special quantitative methods. In the laboratory the following experiments are performed. The gravimetric determination of chlorine in a soluble chloride; water of crystallization in copper sulphate; iron and sulphur in ferrous sulphate; carbon dioxide; calcium and magnesium in dolomite; aluminum in an alum; closing with a complete analysis (technical) of a clay.

306. Quantitative Analysis.

Required in I, II, III, IV and V.

Prerequisites: Course 305.

Time: Sophomore year, second semester.

Lecture, one period a week.

Laboratory, six periods a week.

A thoroughly practical course, largely volumetric, in the determination of the important constituents of ores and metallurgical products. The methods taught are those in use in the large smelters of the West. The student works upon checked samples of widely varying composition until he becomes familiar with the various methods and can carry them out under all conditions with accuracy and rapidity.

Each student is required to analyze two or more ores for each

of the following: Iron, copper, zinc, lead, phosphorus, calcium, manganese, sulphur and arsenic. The essential parts of the course are speed tests, in which the students are required to report correct results on a number of copper, zinc and lead ores.

307. Advanced Quantitative Analysis.

Prerequisites: Course 306.

Time: Junior year, first semester.

Laboratory, four periods a week.

This is an extension of Course 306. The student is permitted some choice in the work to be pursued. It may consist of methods of determination of Molybdenum, Tungsten, Uranium, Vanadium and others of the more important commercial alloy metals.

308. Electro-Analysis.

Required in II and V.

Prerequisites: Course 306.

Time: Junior year, second semester.

Laboratory, six periods a week.

This course will deal with the practical application of the electric current in determining some of the common metals, such as copper, silver, lead and zinc. After the student has become familiar with the methods used for determining each of these, he will use the current in separating mixtures of metals and as a rapid, accurate method of ore analysis.

309. Metallurgical Analysis.

Required in II.

Prerequisites: Course 306.

Time: Junior year, first semester.

Laboratory, eight periods a week.

In this course the student may select such of the following as are best suited to his needs: analysis of rocks and minerals, spieesses, crude and refined lead and copper bullion, spelter, iron and steel, alloys, cement, or the determination of some of the rare elements.

310. Physical and Theoretical Chemistry.

Required in II.

Prerequisites: Course 306.

Time: Senior year, second semester.

Lectures, two periods a week.

The elements of theoretical chemistry have already been studied in the course in general chemistry, qualitative and quantitative analysis. The subject is here pursued more exhaustively. The principal subjects considered are: The gas laws, atomic and molecular weights and the methods of determining them, forms and the phase rule, kinetic theory, thermochemistry, ionization, dissociation and balanced actions and electro-chemistry.

311. Industrial Inorganic Chemistry. (Special.)

Prerequisite: Course 302.

Time: Junior year.

Lectures, two periods a week.

The utilization of inorganic materials in manufacturing processes was taken up in an elementary way in connection with general chemistry. This special industrial course goes into the subject considerably more in detail. The manufacturing processes considered are mainly those of acids, alkalis, mineral dyes, mineral paints, explosives and matches.

The aim is to expound the dominant principles underlying each process rather than to present such an account of the details as will suffice for the student of any particular industry. In this manner, the student is prepared to study efficiently the literature of any branch in which he may afterwards become especially interested.

312. Organic Chemistry. (Special.)

Prerequisite: Course 302.

Time: Junior year.

Lectures, two periods a week.

Laboratory, six periods a week.

This course serves as an introduction to the study of the hydrocarbons of both the fatty and aromatic series, alcohols, phenols, aldehydes, organic acids, ethers, esters and carbohydrates. Their formation, relations and derivatives are discussed, and special attention is given to the explanation of familiar organic phenomena.

313. Oil Analysis. (Special.)

Apparatus has been installed by the school making it possible to make the more important determinations necessary in Oil

Analysis. These determinations include Flash Point, Burning Point, Cold Point, Viscosity, Specific Gravity, Calorific Value, Sulphur in the oil, and Fractionation.

The above tests are made by methods standard throughout the United States.

DEPARTMENT OF CIVIL ENGINEERING

PROFESSOR OCKERBLAD.

The courses in engineering described in the pages immediately following are designed to train the student in the theory and practice of those subjects which form the basis of professional practice. He is taught the construction, care and use of engineering instruments and the methods used in the solution of the usual problems of practice. The advanced courses give special attention to materials for roads, highways, buildings and general engineering construction, and the methods used in conventional design of engineering structures.

Opportunities are numerous for the study of irrigation and drainage engineering as the Rio Grande Project of the United States Reclamation Service of which the Elephant Butte dam is a part, is within ninety miles of Socorro.

401. Mechanical Drawing.

Required in I, II, III, IV and V.

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Laboratory, six periods a week.

This course involves the use of instruments, geometric construction, representation of objects by orthographic and isometric projections. Special attention is given to lettering, shading and the principles of dimensioning.

402. Descriptive Geometry.

Required in I, II, III, IV and V.

Prerequisites: Courses 401 and 103.

Lectures, one period a week.

Laboratory, three periods a week.

The representation of all geometrical magnitudes is made possible by means of orthographic projections. The student is required to solve various problems involving points, lines, surfaces and solids and demonstrate same at blackboard.

403. Machine Drawing.

Required in I, II, III, IV and V.

Prerequisites: Course 401.

Time: Junior year, first semester.

Laboratory, three periods a week.

Here the student makes working drawings from machine parts; first, while having this part directly before him, and later, from a freehand sketch of the part, without having the latter to look at while drawing. He thereby becomes familiar not only with methods of dimensions, laying out and reading working drawings, but also those of making and using sketches. Throughout the entire course particular stress is laid on neat lettering, correct dimensioning and symmetrical arrangement of drawings.

404. Machine Design.

Required in I and II.

Prerequisites: Courses 401, 402, 403, 423.

Time: Senior year, second semester.

Laboratory, three periods a week.

A study of the design of machine elements and modern machines and of the nature, strength and action under stress of the materials used in machine construction. Recitations are carried on, including the discussion of problems suitable for illustration of important points. In the drafting room each student completes the design of some especially assigned machine.

406. General Surveying.

Required in I, II, III, IV and V.

Prerequisites: Courses 101 and 103.

Time: Freshman year, second semester.

Lectures, two periods a week.

Field Work, four periods a week.

An introductory course in surveying, including the use, care, and adjustment of instruments; linear and angular measurements with the transit, level, compass and minor instruments. Students are given practice in traversing, computing areas, triangulating, topographic mapping and the keeping of accurate notes.

407. Mine Surveying and Mapping.

Required in I, II, III, IV and V.

Prerequisites: Course 406.

Time: Sophomore year, first semester.

Lectures, one period a week.

Field Work and Mapping, four periods a week.

The course involves lectures and recitations on the theory of Mine Surveying as applied both to surface claims and underground workings. Actual survey of the Merritt Mine and a complete map of the underground workings is required of each student.

408. Topographic Surveying.

Required in I, II, III, IV and V.

Prerequisites: Course 406.

Time: Sophomore year, second semester.

Lectures, two periods a week.

Field Work, four periods a week.

This course deals with use of transit and plane table in topographic surveying. Stadia and other methods used in locating topographical features. Use of triangulation and base lines also considered. A complete survey will be made and plotted.

409. Irrigation and Drainage.

Required in IV.

Prerequisites: 427, accompanying 410, 408 and 406.

Time: Senior year, first semester.

Lectures, two periods a week.

Field Work, three periods a week.

Part I. A course for Civil Engineers, embracing the study of irrigation and irrigation problems, including design of irrigation systems and the consideration of the adaptability of different soils to irrigation.

Part II. This course involves a discussion of the drainage problems inseparable from irrigation projects.

410. Railroad Surveying.

Required in IV.

Prerequisites: Courses 406, 408.

Time: Junior year, second semester.

Lectures, two periods a week.

Field Work and Drawing, six periods a week.

The course includes the study of the economic theory of railway location, computation of railway curves, transitions, turn-outs, and earth works. The field work involves preliminary

and location surveys, computing, making notes for and locating simple and compound curves.

412. Mechanics.

Required in I, II, III and IV.

Prerequisites: Courses 106 and 201.

Time: Junior year, second semester.

Lectures, five periods a week.

This course treats of composition and resolution of forces, center of gravity, couples, conditions of equilibrium, moment of inertia, flexible cords, rectilinear, curvilinear and rotary motion, work, energy, friction, impact etc.

413. Roads and Pavements.

Required in IV.

Prerequisites: Courses 406 and 410.

Time: Junior year, first semester.

Lectures, two periods a week.

Laboratory, three periods a week.

A study of the various methods of construction of the different types of roads and pavements, road materials, care of road surfaces, the proper use of paving materials and the economics of road building.

The laboratory work consists of testing road materials and the solution of practical problems.

414. Railroad Engineering.

Required in IV.

Prerequisites: Course 410 accompanying.

Time: Junior year, second semester.

Lectures, three periods a week.

This course treats of the economical location and operation of railroads, limiting gradients and curvature, train resistance, compensation for curvature, systems of signaling and general railroad organization.

415. Theory of Structures.

Required in IV.

Prerequisites: Courses 103 and 202.

Time: Junior year, first semester.

Lectures, three periods a week.

Laboratory, three periods a week.

The study of graphic statics and analytical methods as applied to roof and bridge trusses, involving loads, reactions, shears, moments, shear and moment diagrams and graphical analysis of trusses.

416. Cement Testing.

Required in IV.

Prerequisites: Courses 301, 302, 201, 202, and 417.

Time: Junior year, second semester.

Laboratory, six periods a week.

The student is required to make the ordinary physical tests of cement, such as weight, specific gravity, fineness, time of set, pat tests, and the making and breaking of briquetts and cubes of neat cement and mortar.

417. Materials of Construction.

Required in I, II, III and IV.

Prerequisites: Courses 103, 202, 413 accompanying.

Time: Junior year, first semester.

Lectures, three periods a week.

The study of the principles of mechanics underlying the laws of the strength of materials; involving elastic and inelastic materials, their action under stresses of all kinds, results of tests of materials, curves of strength, a study of the strength of steel of varying composition and the fatigue of metals.

419. Masonry Construction.

Required in I and IV.

Prerequisites: Courses 412, 423 accompanying.

Time: Senior years, first semester.

Lectures, two periods a week.

In this course the attention of the student is directed chiefly toward the use of cement as a building material; concrete and other forms of masonry are studied in foundations, piles, retaining walls, dams, buildings and bridges, practical problems in computation and design are included.

420. Pumping.

Required in I, II and IV.

Prerequisite: Course 425.

Time: Senior year, second semester.

Lectures, two periods a week.

Part 1. Discussion of pumping, pump problems, and pump details. Types of pumps: Force pumps, crank and flywheel, direct acting, duplex, compound and triple expansion pumps.

Part II. A study of the action of air during compression and expansion; its flow through pipes; and, also the various types of air compressing and actuating machinery.

421. Contracts and Specifications.

Required in IV.

Prerequisites: Courses 802, 804 and 417.

Time: Senior year, first semester.

Lectures, two periods a week.

Laws of contracts covering contracts, agency, torts, and independent contractor; contracts of sale, association, transportation, etc. Study of engineering contracts and specifications with problems in contract and specification writing.

422. Heat Power Engineering.

Required in I and IV.

Prerequisites: Courses 412, 201, 202, 301 and 302.

Time: Senior year, second semester.

Lectures, two periods a week.

This course is devoted to the study of the theory and construction of all heat engines used in modern engineering practice. The student upon the completion of this course should be capable of designing all the essential parts of the prime mover of a small steam plant.

423. Strength of Materials.

Required in I, II, III and IV.

Prerequisite: Course 412.

Time: Senior year, first semester.

Lectures, three periods a week.

This course is a study of the stresses and deformation of bodies subjected to tension, to compression, to shearing, to torsion; the study of elasticity of bodies; stresses in and design of pipes, riveted joints and hooks; treats of the theory of beams with discussion of bending moments, shearing forces and distribution of stress.

424. Bridge Design.

Required in IV.

Prerequisites: Courses 412, 423 and 415.

Time: Senior year, second semester.

Lectures, two periods a week.

Laboratory, three periods a week.

A study of the different types of simple span bridges, trusses, cantilevers, plate girders, etc., and of the design of a bridge of a selected type.

425. Hydraulics.

Required in I, II, III and IV.

Prerequisite: Course 412.

Time: Senior year, first semester.

Lectures, two periods a week.

Study of fluid pressure, and laws governing the flow of water through orifices and pipes, over weirs, in closed conduits, and in open channels. The hydraulic laws relating to water wheels, etc., are briefly discussed.

426. Structural Design.

Required in IV.

Prerequisites: Courses 412, 415 and 423.

Time: Senior year, second semester.

Lectures, three periods a week.

Laboratory, three periods a week.

A course in which each student is given a different set of data and is required to make computations, designs and working drawings of several structures, such as a roof truss, plate girder and a riveted or pin connected bridge.

427. Hydraulic Engineering.

Required in IV.

Prerequisites: Courses 412, 425 accompanying.

Time: Senior year, first semester.

Laboratory, three periods a week.

A course for civil engineers in river hydraulics for power or irrigation, including the study of drainage areas, steam flow, discharge and rating curves, storage reservoirs for power or irrigation and the economics of water supply engineering.

428. Municipal and Sanitary Engineering.

Required in IV.

Prerequisite: Courses 425, 406, 408.

Time: Senior year, second semester.

Lectures, two periods a week.

Laboratory, three periods a week.

A study of quantity of house-sewage and storm water, and the shape and dimensions of pipes and conduits for carrying the same. The use of flush tanks, man-holes and the ventilating systems.

429. Cost Keeping and Management.

Required in IV.

Prerequisites: Course 421 accompanying.

Time: Senior year, first semester.

Lectures, one period a week.

An elementary course on principles which govern the organization and management of labor on construction; systems of measurement, payment and efficient methods of cost keeping.

DEPARTMENT OF GEOLOGICAL ENGINEERING

PROFESSOR WELLS.

501. General Geology.

Required in I, II, III, IV, and V.

Prerequisites: Entrance requirements.

Time: Sophomore year, first semester.

Lectures, three periods a week.

Occasional field trips.

This course is designed to give a thorough foundation on which to base the more advanced geological courses that follow. It consists of lectures, recitations, laboratory work with the common minerals and rocks, the study and interpretation of topographic maps, and occasional excursions into the field.

Dynamic and structural geology are the two branches of the subject receiving the greatest emphasis. The laws and methods of interpretation are discussed with considerable detail, training in the deciphering of geological phenomena being the object sought.

The area surrounding Socorro is especially rich in varied and striking geological types. Socorro Mountain rising 2,500 feet above the campus, presents many typical rocks and many structures associated with volcanic districts. Sedimentary rocks of Pennsylvanian, Permian, Triassic, and Cretaceous age are well exposed a few miles to the east. The local geological occurrences are utilized wherever practicable to illustrate the subject matter of the course.

502. General Geology.

Required in I, II, III, IV, and V.

Prerequisite: Course 501.

Time: Sophomore year, second semester.

Lectures, two periods a week.

Laboratory, one period a week.

Historical geology comprises the major portion of the course. The various eras, periods, and epochs of the earth's history from cosmic to present time are studied in chronological order. The distribution and classification of the sedimentary rocks are taken up and the methods of correlation explained. In the

study of the life of the earth during earlier geological eras as recorded by the fossils, special attention is paid to the development of characteristic and predominant forms. Throughout the course those phases of historical geology are emphasized, the understanding of which is essential to the intelligent perusal of geological literature.

503. Economic Geology.

Required in I, II and III.

Prerequisites: Courses 501, 502, 509 and 510.

Time: Junior year, first semester.

Lectures, two periods a week.

This course, together with course 504, takes up the origin, nature, and occurrence of the economically valuable mineral deposits, both metallic and non-metallic; the various deposits being classified according to their origin rather than their chemical composition. Type forms, especially those developed in the United States, are emphasized. Among the non-metallic deposits studied are coal, oil, gas, cements, gypsum, salt, sulphur, clay, building stones, abrasives, gems, soils, and fertilizers. The study of the metallic ore deposits includes those of iron, copper, lead, zinc, silver, gold, platinum, and minor metals. Many New Mexico deposits are considered.

504. Economic Geology.

Required in I, II and III.

Prerequisite: Course 503.

Time: Junior year, second semester.

Lectures, three periods a week.

In this course the work outlined in course 503 is completed. Most of the time is given to a study of the deposits worked for the common and rare metals.

505. Oil and Gas Geology.

Required in III.

Prerequisites: Courses 503, 504, 511 and 512.

Time: Senior year, first semester.

Lectures, two periods a week.

This course deals with the origin of oil and gas, stratigraphy and structure applied to oil and gas, accumulation, locating wells, drilling, prospecting and geological mapping, reports on

oil and gas prospects and properies, valuation of properties, oil and gas fields of North America, and oil shales.

506. Ore Deposits.

Required in I, II and III.

Prerequisites: Courses 503 and 504.

Time: Senior year, second semester.

Lectures, two periods a week.

Deposits of the metallic ores are here treated more intensively than is possible in the time allotted to Course 504. The principles of secondary enrichment receive detailed treatment; also their application to the various types of ore deposits. The chemistry and mineralogy of secondary enrichment are considered with the purpose of giving the student sufficient knowledge along these lines to determine whether a given ore deposit is of primary or secondary origin and whether or not it is liable to continue to considerable depths. The important ore deposits of the United States which are characterized by secondary enrichment are carefully studied in that connection.

507. Field Geology.

Required in I and III.

Prerequisites: Courses 501, 502, 503, 504, 509, 510, 511, 512, 408.

Time: Senior year, first semester.

Lectures, one period a week.

Field work, eight periods a week.

Actual field practice comprises the larger part of the work, but a considerable portion of the time is devoted to the writing of reports, office work in the construction of geological maps and sections, and the study of similar maps of the United States Geological Survey. The field work consists both of the rapid mapping of geological formations in large areas and the accurate location and mapping of formation boundaries, faults, vein outcrops, etc., in restricted areas. Practice is given in the use of the plane table and alidade when the party consists of several members, and of the small plane table and the geologist's compass as utilized for geological mapping when no assistant is available. Geological boundaries are also located on topographical maps with the aid of the contours alone. The report required at the end of the course includes the probable geological history, classification of formations, and dominant geological

processes illustrated in the area studied, as well as appropriate geological maps.

508. Applied Geology.

Required in III.

Prerequisite: Course 507.

Time: Senior year, second semester.

Lectures, two periods a week.

Field work, eight periods a week.

This course is designed primarily for students specializing in geological engineering. The field work is confined as far as practicable to neighboring mining districts, and includes the study of the various surface structures, vein outcrops, underground and surface geological mapping, and the solution of problems dealing with the methods of ore deposition and occurrence. The petrographic and chemical examination of the rocks and ores under consideration constitutes a portion of the course. The work given may be varied in part according to the preference of the student.

509. Mineralogy.

Required in I, II, III, IV, and V.

Prerequisites: Courses 301, 302, and 304.

Time: Sophomore year, first semester.

Lectures, two periods a week.

Laboratory, three periods a week.

Crystallography occupies a portion of the first ten weeks of the course. Only those phases are emphasized which are of practical value in the determination and proper understanding of minerals, the drill in this portion of the subject being quite thorough. In the laboratory work each student is required to become familiar with the various crystal forms as illustrated by the large number of crystal models and well-developed crystal minerals in the school collection. Proficiency is required in the determination of interfacial angles by means of the contact goniometer and the determination of the crystal form of microscopic crystals by examination with the hand lens.

Practice in the determination of the elements found in minerals accompanies the instruction in crystallography. Blow-pipe identifications are emphasized as far as is consistent with dependable results. For those elements which do not give distinctive reactions in blow-pipe analysis, the most satisfactory wet methods of determination are used.

After the completion of the above work the minerals are taken up in systematic order. Over two hundred and fifty of the more common minerals are considered in this and the following course, stress being placed on their recognition by means of crystal form, cleavage, hardness, specific gravity, luster, and other physical properties. The order of study followed in the lectures is: The elements, sulphides, sulpho-salts, haloids, oxides, aluminates, ferrites, hydroxides, carbonates, phosphates, nitrates, borates, sulphates, tungstates, molybdates, and silicates. The relative values of the minerals, both from the standpoint of economic use and mineralogical significance are emphasized.

510. Mineralogy.

Required in I, II, III, IV, and V.

Prerequisite: Course 509.

Time: Sophomore year, second semester.

Lectures, three periods a week.

Laboratory, three periods a week.

The study of the individual minerals begun in Course 509 is here continued. The latter portion of the semester's work is spent in the determination of the unknown minerals both in the usual form of occurrence and in a powdered condition. Those minerals which cannot be determined by physical characteristics are tested by appropriate blow-pipe and wet methods. The ability to identify the common minerals alone and in combination as they are likely to be found in field practice is the aim kept in view.

511. Petrology.

Required in I and III.

Prerequisites: Courses 501, 502, 509, and 510.

Time: Junior year, first semester.

Lectures, one period a week.

Laboratory, three periods a week.

The effective study of rocks in their different aspects is the purpose of this, and the following courses, which are here described together. The igneous, sedimentary and metamorphic divisions are taken up in considerable detail, both from a megascopic and microscopic standpoint.

The classification of rocks according to Kemp, together with the theory and manipulation of the petrographic microscope

and the study of oriented sections of a large number of individual minerals, occupy the first eight weeks of the course. Upon the completion of this work, the various rock species are considered, the attention paid to any particular type being determined by its frequency of occurrence and importance in general geological practice. Thin sections of the various rock specimens in the collection are used as far as possible, so that the student may have the benefit of comparing and confirming megascopic determinations with the more accurate results of microscopic examination.

The microscope is also used to unravel the relations of the individual minerals in fine grained rocks, their order of crystallization, and other characteristics that are not apparent in the examination with the hand lens alone. In this connection the sedimentary and metamorphic rocks, as well as the igneous varieties, are utilized.

Along with the above work general metamorphic processes, both constructive and destructive, are given considerable attention, especially as they affect the development of the various rocks.

512. Petrology.

Required in I and III.

Prerequisite: Course 511.

Time: Junior year, second semester.

Lectures, one period a week.

Laboratory, three periods a week.

The work given under Course 511 and 512 is conducted throughout the year as described under the former course.

513. Paleontology.

Required in III.

Prerequisites: Courses 501 and 502.

Time: Senior year, first semester.

Lectures, two periods a week.

Laboratory, three periods a week.

This course is intended primarily for those specializing in geological engineering and is a much more thorough course than can be given in the brief time allotted to Paleontology in Course 502. It includes the study of the invertebrate index fossils characteristic of the geological horizons of North America.

514. Ore Deposits.

Required in III.

Prerequisites: Courses 503 and 504.

Time: Senior year, second semester.

Lectures, five periods a week.

The material here offered is the same as that given under Course 506 with some additional instruction along similar lines for the benefit of geological engineers. Two of the five periods are the same as in Course 506. The other three periods are given as arranged for at the convenience of the instructor and the students taking the course.

515. Petrology.

Required in III.

Prerequisites: Courses 501, 502, 509 and 510.

Time: Junior year, first semester.

Lecture, one period a week.

Laboratory, six periods a week.

This course is offered for those following the geological engineering curriculum. It is an amplification of Course 511, the work given in the lectures and for three periods a week in the laboratory being the same as in the briefer course, and at the same hours. The additional laboratory work is utilized for more searching examinations of slides and hand specimens and for the consideration of a greater variety of rocks.

516. Petrology.

Required in III.

Prerequisite: Course 515.

Time: Junior year, second semester.

Lectures, one period a week.

Laboratory, six periods a week.

This course is a continuation of Course 515. With the exception of three laboratory periods of each week, which are conducted by special arrangement as to time, the work is the same as given in Course 512.

DEPARTMENT OF MINING ENGINEERING

PROFESSOR SNYDER

601. Principles of Mining.

Required in I, II, III and IV.

Prerequisites: Courses 104, 202, 201, 301, 305, 306, 501, 502.

Time: Junior year, first semester.

Lectures, two periods a week.

The following subjects are studied:

Mineral deposits, their classification from a mining standpoint and their irregularities as affecting the work of exploration and mining.

Prospecting by panning, trenches, test pits, boring and drilling. Testing of placers and ore deposits with well or churn drills.

Excavation of earth; tools; methods; supports.

Excavation of rocks; explosives, kinds, nature, manufacture and use; methods of drilling and blasting, mammoth blasts; quarrying.

Machine drills: Construction and operation.

Tunneling: Methods of driving and timbering; permanent linings; sizes, speeds of advance and costs.

Boring: Methods and appliances for small depths and for deep boring; the diamond drill; survey of bore holes.

Shaft-sinking: Methods and tools for both hard and soft material; sinking; lining; handling and hoisting of material; timbering, walling and tubing.

Methods of support: Pillars, timbers, filling.

Surface-handling and transportation; arrangements for loading, unloading and storage of minerals; mineral railroads and common roads.

Ore extraction by systems of overhand and underhand stoping; caving by top slicing and sub-drifting; support of workings by filling and square setting.

Underground haulage: Mine cars; arrangements of tracks; hand tramping; mule and rope haulage; gravity roads; steam, compressed air and electric locomotives.

Hoisting: Engines, drums, wire rope, skips and cages; head-frames; calculation of power required and methods of equaliz-

ing the load on the engine; devices for prevention of over-winding; shaft-sinking plant.

Arrangements at top and underground landings: Ore-pockets; signaling, etc.

Drainage: Buckets, tanks and head-pumps; Cornish and direct-acting underground pumps; operation of pumps by electricity, compressed air and hydraulic power.

Ventilation: Natural ventilation, underground furnaces, positive blowers and centrifugal fans; efficiency of fans.

Illumination: Candles; torches, lamps classified as oil, gasoline, magnesium, acetylene, electric and safety.

Accidents to men from fire-damp, dust explosions, mine-fires, falling material and inundations; prevention; rescue and relief.

602. Principles of Mining.

Continuation Course, 601.

Prerequisites: 601.

Time: Junior year, second semester.

Lectures, two periods a week.

603. Ore Dressing.

Required in courses I, II, III and V.

Prerequisites: Courses 104, 201, 701, 702, 202, 203.

Time: Senior year, first semester.

Lectures, two periods a week.

Laboratory, three periods a week.

This course includes a detailed study of severing by means of breakers, rolls, stamps and fine grinding machines; the sizing and classification of pulps by mechanical, pneumatic, and hydraulic processes; the principles and importance of sizing and classifying; the separation and concentration by hydraulic and electrical methods and also by means of flotation processes.

604. Ore Dressing.

Required in I, II and III.

Prerequisites: Courses 104, 201, 603, 202, 701, 702, 203.

Time: Senior year, second semester.

Lectures, two periods a week.

This course is a continuation of Course 603.

605. Mine Examination.

Required in I and III.

Prerequisites: Courses 701, 702, 502, 407, 408, 503, 504, 511, 512, 412.

Time: Senior year, first semester.

Laboratory, three hours a week.

The main object sought in this course is to train the student sufficiently in expert mine examination work to enable him to report intelligently upon a mining proposition as to the advisability of purchase or of operation.

Practice is afforded in making regular reports, complete in every respect, on different kinds of mining properties. Each student is assigned a different mine or property to examine. In case the mine has been reported upon in previous years, detailed comparison of the results is afterwards made.

Among the more important topics usually considered are the topography of the district as an index to its accessibility, outside construction, the character of the geological formations, the geological structure (particularly as affecting the ore bodies), the character and disposition of the ores, the amount of ore developed, the probable extent of the unexplored part of the deposit, the best method of extracting the ore, of concentrating it, of preparing it for shipment or treating it immediately for the metal, the water facilities and the facilities for transportation to market. Full computations are required, including estimates of the cost of each process, of the necessary plant.

607. Mine Administration and Accounts.

Required in courses I, II, III.

Prerequisites: Courses 407, 408, 502, 701, 702, 601, 602.

Time: Senior year, first semester.

Lectures, one period a week.

Particular stress is laid on the business aspects of mining operations. The value of keeping tabulated record of different grades of work and its cost from day to day is urged as a means of constantly reducing the fixed charges and of doing away with much of the extraordinary expenditures without reducing the efficiency of the work. The devising of methods of increasing the output with limited working forces is emphasized.

The subject of labor in its various phases, the details of supplies, mine accounts, statements of cost, and monthly reports are discussed.

608. Design of Mine Plant.

Required in I and III.

Prerequisites: Courses 603, 604, 412, 423, 425.

Time: Senior year, second semester.

Laboratory, three periods a week.

The student is assigned problems relating to a given mine. He makes the requisite surveys, plans the top-works, selects the requisite machinery for a special duty, and designs in detail and makes working drawings of those features of Hoisting, Hauling, or Drainage Plant, or of the Ore Handling Plant, as may be assigned to him. On these portions he draws up specifications, bills of materials, and estimates of cost.

If an operating mine be selected for this, the entire work is examined, improvements incorporated, and suggestions made as to possible savings.

609. Fuel and Boiler Water Analysis.

Required in Course I.

Prerequisites: Courses 304, 305 and 306.

Time: Junior year, first semester.

Laboratory, four periods a week.

Analysis of various coals and other fuels are made, and their heat values calculated from these analyses, also determined by means of a calorimeter. This is a more or less practical course in fuel testing and is especially adapted to the needs of a mining engineer.

Analyses of water are made in regard to their possible use in boilers. These analyses involves the determination of total solids, organic and volatile matter, silica, alumina and iron, calcium, magnesium, sodium and potassium, carbonic, sulphuric and hydrochloric acids.

610. Mining Law.

Time: Junior year, second semester.

Lectures, two periods a week.

This course is designed to give the student a working knowledge of the mining laws of the United States and of the various states. The statutes will be discussed and compared, and the leading cases will be studied. The mining claim will be followed from its inception upon the open, unappropriated public domain, through the various steps of discovery, location, develop-

ment, abandonment, forfeiture and re-location, up to and including the proceedings for patent. Conflicts, interference of claims, cross and uniting lodes, extralateral rights, parallel end lines and similar questions will be dealt with from the standpoint of the practical miner, so far as possible.

This course will be devoted primarily to lode claims, but will close with a few lectures on placers, millsites and tunnels.

Text book: Costigan's *American Mining Law*.

DEPARTMENT OF METALLURGICAL ENGINEERING

PROFESSOR SNYDER.

701. Fire Assaying.

Required in I, II, III and V.

Prerequisites: Courses 305, 306, 501, 502, 509, 510, 703, accompanying.

Time: Junior year, first semester.

Lectures, one period a week.

The instruction in assaying is given by means of lectures and laboratory experimentation, the practice in the laboratory illustrating the lecture-courses. The laboratory is well equipped with several different types of assay-furnaces for crucible work, scorification, and cupellation, and with everything that goes to make up a well furnished assay office.

This course comprises fusion methods for gold, silver and lead. The crucible-assay of oxidized ores for gold and silver in the muffle and in the pot-furnace; crucible assay of sulphide ores for gold and silver by the iron, roasting, and preliminary fusion methods; also the crucible-assay of lead ores. The scorification-assay of litharge and lead. In the assay of base-bullion, silver-bullion and gold-bullion, the methods in use in the United States mints are followed. Sampling and the preparation of the sample for assay; making cupels, and the management of the assay office and the special duties of practical assayers are considered.

Numerous samples are provided, all of which have been previously accurately assayed at the school, at the smelter whence they came, or at the mint. The student works upon these until he attains a high degree of proficiency. No student is allowed to pass this subject until he has become proficient in assaying.

702. Fire Assaying Laboratory.

Required in I, II, III and V.

Prerequisites: Courses 305, 306, 501, 502, 509, 510, 701, 703, 704 accompanying.

Time: Junior year, second semester.

Laboratory, six periods a week.

This course is the laboratory work of Course 701.

703. Principles of Metallurgy.

Required in I, II, III and V.

Prerequisites: Courses 301, 302, 201, 202, 509, 510, 304, 305, 306.

Time: Junior year, first semester.

Lectures, three periods a week.

A study of the physical and chemical properties of ore and metals as determinants in extraction-methods; furnaces, their classification and structure; fuels and thermal measurements; characteristic metallurgical processes; materials and products of metallurgical process; alloys; thermal treatment of metals preparatory to their use.

Particular stress is laid upon the study of the more recent metallurgical practices and improvements of older processes. The course is supplemented by visits to neighboring plants.

704. Metallurgy of Iron and Steel and Principles Metallurgy.

Required in I, II, III, IV and V.

Prerequisites: Courses 301, 509, 703, 302, 304, 305, 306, 201, 202.

Time: Junior year, second semester.

Lectures, three periods a week.

This course takes up the metallurgy of iron and steel in detail, in the following order, properties of iron, its alloys and compounds; specifications for standard iron and steels; ores of iron and the preparation of them for the blast furnace and its operation; manufacture of pig iron and its properties; calculation of furnace charges; chemistry of the blast furnace and the operation of same; blowing engines; furnace gases; treatment of flue dust; manufacture of steels by the basic and acid Bessemer processes; basic and acid Open Hearth processes; crucible steel manufacture; the making of wrought iron; structure of iron and steel; mechanical and heat treatment.

Principles of Metallurgy is not completed in one semester. The latter half of this semester is devoted to the metallurgy of iron and steel.

705. Metallurgy of the Non-Ferrous Metals.

Required in I, II, III.

Prerequisites: Courses 703, 704.

Time: Senior year, first semester.

Lectures, three periods a week.

This course includes a study of the metallurgy of lead, copper, zinc, gold, silver, antimony, nickel, tin, bismuth, and tungsten. They are given in the order listed below:

Metallurgy of Gold and Silver.

Occurrence of gold and silver; placer mining; the patio process; crushing and amalgamating machinery; pan amalgamation; chlorination by the vat and barrel process; cyaniding by the MacArthur-Forest and Siemens-Halske processes; modern methods of cyanide treatment of slimes by pressure and vacuum filters; lixiviation of silver ores; pyritic smelting, refining and parting of gold bullion.

Metallurgy of Copper and Lead.

Occurrence of copper; roasting copper ores in heaps, stalls and roasting furnaces; blast-furnace smelting; pyritic smelting; reverberatory smelting; bessemerizing copper mattes; electrolytic refining of copper; selection of process and management of plant; occurrence of lead ores; methods of roasting and roasting furnaces; Corinthian, Silesian and English methods of reverberatory smelting; blast furnace smelting; calculation of blast furnace charges; and desilverization of base bullion, etc.

Metallurgy of Zinc and Minor Metals.

This subject takes up the roasting of zinc ores; zinc distillation process; furnaces; purification of spelter; and commercial consideration of such metals, also the metallurgy of Antimony, Nickel, Tin, Bismuth, Tungsten and Arsenic.

706. Metallurgy of the Non-Ferrous Metals.

Required in I, II, III.

Prerequisites: Courses 703, 704, 705.

Time: Senior year, second semester.

Lectures, three periods a week.

This course is a continuation of Course 705.

708. Metallurgy Laboratory.

Required in I, II.

Prerequisites: Courses 705, 706, accompanying 701, 702, 203, 703, 704.

Time: Senior year, second semester.

Lectures, one period a week.

Laboratory, six periods a week.

Laboratory work and investigation will be conducted along some of the following lines: Amalgamation of ores of gold and silver, chlorination of gold and silver ores, cyanidation of gold and silver ores, leaching methods for copper ores, electrolytic refining for copper and lead, slags.

Note. Analyses of water are made in regard to their possible use in boilers. These analyses involve the determination of total solids, organic and volatile matter, silica, iron and alumina, calcium, magnesium, sodium, potassium, and carbonic, sulphuric and hydrochloric acids.

Analyses of various coals and other fuels are made, their heat values calculated from these analyses and also determined by means of a calorimeter. Flue gases are analyzed and the results interpreted. The flash-point, burning point, specific gravity, viscosity and acidity of oils are determined.

This work also includes the laboratory work to be done in Ore Dressing as listed in the Senior year, first semester, three hours a week.

709. Metallurgical Calculations.

Required in II.

Prerequisites: Courses 703, 704.

Time: Senior year, first semester.

Lectures, one period a week.

A course based on Richard's Metallurgical Calculations. It is designed to bring the student in contact with the more important calculations in connection with the practice of thermochemistry and various smelting operations, also electro-metallurgy.

711. Metallurgical Plant Design.

Required in II.

Prerequisites: Courses 415, 703, 704, 412, 423, 705 accompanying.

Time: Senior year, first semester.

Laboratory, six periods a week.

The student devotes his time to detailed and original plans for a plant for ore treatment. From year to year the conditions vary so that no two students have the same work. The working plans for part of the buildings, concentrators, furnaces, etc., are drawn up complete in every respect, the full bills of materials are made out for the portions of the work assigned, and

the cost of the several parts carefully estimated according to the trade conditions and labor factors existing at the time. The entire work and all computations are carried out according to the best engineering practice and with the same care that actual construction operations require.

712. Metallurgical Plant Design.

Required in II.

Prerequisites: Courses 415, 703, 711.

Time: Senior year, second semester.

Laboratory, six periods a week.

This is a continuation of Course 711.

713. Metallography.

Required in II.

Prerequisites: Course 703.

Time: Senior year, first semester.

Lectures, one period a week.

Laboratory, three periods a week.

This work is a course of lectures including the study of the micro-structure of iron and steel, of the non-ferrous metals, some commercial alloys and the influence of heat treatment, also mechanical, on these structures; the study of equilibrium and of the phase rule applied to alloys.

The laboratory work consists of the preparation and microscopical examination of the variously treated iron and steel alloys and the photographing of their structures; also the construction of equilibrium diagram of alloys.

714. Electro-Metallurgy.

Required in II.

Prerequisites: Courses 703, 704, 705.

Time: Senior year, second semester.

Lectures, two periods a week.

A series of lectures are given covering the electro-metallurgical processes in use at the present time as well as the necessary calculations of efficiency and engineering based on these. **Mining and Metallurgical Trips.**

During the Junior and Senior years occasional trips are taken to the mines, mills, and smelters which are within easy reach of the school. The officials at the various plants have been uniformly courteous in allowing the school the opportunity

to make these visits, and have placed at the disposal of the students everything essential to a clear understanding of the mode of operation.

The excursions give the student a chance to see in operation and practice what heretofore he may have known only theoretically and give him a command of the subject that cannot be obtained in the class-room.

Among the properties visited and at the disposal of the school are:

The old Torrance and Merritt mines, three miles from the campus, in the Socorro Mountains. These mines were once rich producers, but are now being re-exploited.

The Merritt mine has an incline shaft equipped with gasoline hoist and self-dumping skip, and a considerable amount of drifting, raises, winzes, and stopes. Practically all the operations of mining may be seen at these two mines.

The coal mines of Carthage, New Mexico, are within easy reach of the school and present to the student practical problems and their solution, in mining, haulage, ventilation, and water supply. The use of electricity in mining is prominently brought to the student's notice.

The zinc district at Kelley, New Mexico, brings out the fact that success in mining is not all luck. There are three large mines and three mills available for inspection, and the student sees in the mines that geology is a live subject and essential to successful mining. In the mills, he gets his first insight into ore dressing and learns that there is more than one way of doing the same thing.

The Southwestern Portland Cement Company's plant at El Paso is visited and studied from the mechanical point of view. Here are seen in action various types of crushers, grinders, elevators, conveyors, feeders, etc. The company's quarry is a fine example of open cut mining and the student sees the uses of churn drills in drilling holes for blasting large charges.

At the smelter in El Paso, the student sees the working and handling of a large custom plant. Practically everything in the line of copper, lead, and silver smelting is before him for inspection. The methods of sampling, the blast roasting of lead ores, the roasting of copper ores, the blast furnace treatment of lead-silver ores, the blast furnace treatment of copper ores, the reverberatory smelting of copper ores, basic converting, casting machines, power houses, and assay offices are all made the subject of close observation.

DEPARTMENT OF ENGLISH AND SPANISH

PROFESSOR REYNOLDS.

The aim of the courses of instruction in this department is to train the student in the correct use of English and Spanish and to give facility in the writing and speaking of each.

801. English.

Required in I, II, III, IV and V.

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, three periods a week.

A study of the theory of exposition, with special attention to the correct and effective sentence and the proper use of the paragraph. A definite amount of written work is required in order that the student may gain facility in the use of clear, idiomatic English. The subject matter for written work is frequently drawn from other courses pursued by the student, thereby correlating this work with that of other departments.

802. English.

Required in I, II, III, IV and V.

Prerequisite: Course 801.

Time: Freshman year, second semester.

Lectures, three periods a week.

This course is a continuation of 801. Oral expression and composition is a definite part of the class work. Reference reading is required.

803. Technical Business Forms and Reports.

Required in I, II, III, IV and V.

Prerequisites: Courses 801 and 802.

Time: Senior year, first semester.

Lectures, two periods a week.

A study of the best methods of oral and written exposition of the details and problems of engineering and journalistic writing.

804. Technical Business Forms and Reports.

Required in I, II, III, IV and V.

Prerequisites: Courses 802 and 803.

Time: Senior year, second semester.

Lectures, two periods a week.

805. Spanish. (Elective)

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, three periods a week.

Attention is given to the elementary principles of the grammar of the language with the idea of learning the grammar from the language rather than the language from the grammar. Special stress is placed upon conversational exercises.

A part of the class exercise each day consists of cross-translations, both oral and written.

806. Spanish. (Elective)

Prerequisites: Course 805.

Time: Freshman year, second semester.

Lectures, three periods a week.

A continuation of Course 805. It involves translations, prose writing and practice in oral expression.

807. Spanish. (Elective)

Prerequisite: Course 806.

Time: Sophomore year, first semester.

Lectures, two periods a week.

This course consists almost entirely of Commercial Spanish. Business letter writing, reports, and technical expressions receive special attention. Conversation and sight translation give the student an opportunity of acquiring a good working knowledge of the language.

808. Spanish. (Elective)

Prerequisite: Course 807.

Time: Sophomore year, second semester.

Lectures, two periods a week.

This course is a continuation of Course 807.

809. Spanish.

Prerequisite: Course 808.

Time: Junior year, first semester.

Lectures, three periods a week.

This is an advanced course in scientific and technical Spanish, in which an exhaustive study is made of the vocabulary of Mining, Metallurgy, Electricity, etc., intensive work is done in report writing, conversation and sight translations.

810. Spanish.

Prerequisite: Course 809.

Time: Junior year, second semester.

Lectures, three periods a week.

A continuation of Course 809.

ACADEMIC DEPARTMENT

PRINCIPAL O'LOUGHLIN.

The following subjects, specifically prerequisite for admission to the College of Engineering, are regularly offered in the Academy:

FIRST SEMESTER

901. Elementary Algebra.

Time: Five periods a week.

A thorough familiarity with the application of the positive-negative concept of number-value to the four fundamental operations, to factoring, and to simple equations is developed through constant problem work.

905. Plane Geometry.

Time: Five periods a week.

Numerous original problems vitalize the knowledge developed in the study of triangles, quadrilaterals, loci, arcs, chords, secants, tangents, measure of angles, and simple problems in construction.

921. Solid Geometry.

Time: Three periods a week.

This course includes the usual work covering the relations of lines and planes in space; the properties and measurement of prisms, pyramids, cylinders and cones; the sphere; and the spherical triangle.

915. Physics.

Time: Four periods a week.

Laboratory, three periods a week.

This course runs throughout the entire year, the aim being to familiarize the student with the principles of physics, and to serve as an introduction to applied mathematics. Attention is given to the preparation of records, and to the manipulation of apparatus. During this semester the subjects of mechanics, heat and work are studied.

917. English III.

Time: Five periods a week.

The purpose of this course is to give the student a thorough knowledge of the fundamentals of grammar, rhetoric and composition. A considerable amount of composition, both oral and written, is required; thus enabling him to acquire facility of expression.

SECOND SEMESTER**902. Elementary Algebra.**

Time: Five periods a week.

The method of the first semester is continued through the study of fractions, simultaneous equations and graphing, radicals, quadratics and ratio and proportion.

908. Plane Geometry.

Time: Five periods a week.

The method of the first semester is applied to a further study of the characteristics of polygons and of the relation between regular polygons and the circle, supplemented by a careful grounding in the technique of computing area and solving more complicated problems of construction.

920. Physics.

Time: Class room, three periods a week.

Laboratory, three periods a week.

This is a continuation of the first semester's work. Sound, light, and electricity are treated in much the same manner as the subjects of the first half of the year. Throughout the course individual laboratory work is required. Each student must present a satisfactory note book of at least forty experiments performed by him during the year before credit will be allowed by instructor.

918. English III.

Time: Five periods a week.

This course is a continuation of Course 917.

GENERAL INFORMATION

EXPENSES

Matriculation Fee

A matriculation fee of five dollars is required of each student at the time of registration. This fee is paid but once.

Tuition Fee

The fee for tuition is five dollars a semester for residents of New Mexico and fifteen dollars a semester for non-residents.

Athletic Fee

An athletic fee of five dollars a semester is required of each student and is payable to the Registrar upon registration. This will be paid by the Registrar to the Treasurer of the Athletic Association upon the written statement of the Secretary of the Association that the student has signed the constitution. Payment of this fee entitles the student to a season ticket which admits to all athletic contests on the home grounds. Funds obtained from the athletic fees will be put at the disposal of the Athletic Association.

Laboratory Fees

The laboratory fees are intended to cover the cost of materials for which the student does not pay directly and to compensate for the depreciation, due to use, in the value of the apparatus. These fees are payable at the time of registration for each subject, and are as follows:

Chem. 301, General Chemistry.....	\$ 7.50
Chem. 304, Qualitative Analysis.....	7.50
Chem. 305, Quantitative Analysis.....	7.50
Chem. 306, Quantitative Analysis.....	7.50
Chem. 307, Water Analysis.....	5.00
Chem. 308, Electro-Analysis.....	5.00
Chem. 314, Organic Chemistry.....	7.50
Met. 702, Fire Assaying.....	15.00
Geol. 509 and 510, Mineralogy (includes Triple Aplanat lens)	8.00
Mét. 708, Metallurgical Laboratory.....	3.00

Phys. 201, Physics	4.00
Phys. 202, Physics	4.00
Phys. 203, Direct and Alternating Currents	5.00
Academy 915 and 920, Elementary Physics.....	3.00
C. E. 406, Surveying Laboratory.....	2.00
C. E. 407, Mining Surveying Laboratory.....	2.00
C. E. 408, Topographic Surveying Laboratory.....	2.00
C. E. 410, Railroad Surveying Laboratory.....	1.00

The number of fees which a student is required to pay varies with the different curricula. A number of the above fees are for special courses. The charge for laboratory fees in the Freshman year is \$20.00 and in the Sophomore year is \$29.00. The average yearly charge for laboratory fees in the Junior and Senior years in the various curricula is \$20.00.

A deposit of \$2.00 is required from each student who registers for any of the foregoing courses. This deposit will be returned to the student after deducting any amount which may be due from the breakage or damage to apparatus.

The graduation fee, payable on delivery of diploma, is as follows:

Mining, Metallurgical, Geological, or Civil Engineer.....	\$25.00
Bachelor of Science	5.00

Dormitory Accommodations

Students are accommodated with board and lodging at the dormitory at the rate of \$30.00 a month, they being required to furnish only their own bed covering. This rate is fixed for cases in which two students occupy the same room. Five dollars a month additional is charged a student who wishes a room by himself, and no student will be accommodated in this way to the exclusion of another student from dormitory privileges. These fees are required to be paid monthly in advance. A deposit of five dollars is required, also, of each student in the dormitory to cover the cost of possible breakage or damage to his room or its furniture. After paying the cost of such damage or breakage, if any, the balance of this fee is returned to the student at the end of the year.

Rooms in the dormitory are assigned to students in the order of application. Dormitory privileges will be withdrawn from any student for boisterous and disorderly conduct in violation of the rules and regulations governing their action while in or about the building. The privilege of the dormitory is, there-

fore, for students of good behavior and those who wish to study, without being interrupted.

Book and Other Supplies.

Books and other supplies for students are furnished through the office at publishers' prices with the freight or express charges added. A considerable saving is thus made in behalf of the student.

SCHOLARSHIPS

Instructor's Scholarship.—Through the wisdom of the Board of Regents of the School of Mines, there have been provided from two to five scholarships, discretionary to the president, carrying free tuition and from \$150 to \$200 per year. These scholarships are awarded only to worthy young men who have satisfactorily completed at least the college freshman work and who are otherwise worthy of recognition. The students carrying such scholarships shall be selected by the president, and they shall be required to give from one hour to not more than two hours each day instructions in the class room or in the field, shop, or in operating and having charge of machinery, etc., during the active school year, as they may be qualified in or are capable of doing.

School of Mines County Scholarships.—Scholarships are open to one student from each county in New Mexico. These scholarships yield free tuition and are awarded by the president to indigent and worthy students.

ATHLETICS

Physical training has become a distinct feature of the student's activity at nearly all institutions of higher education. Rationally indulged in it is an exceedingly valuable feature, as it is attested by past experience. The young man who gives promise of greatest usefulness, is sound in both mind and body. The health of the body and the consequent health of the mind cannot be promoted without proper attention to the laws of physical exercise. Physical training thus becomes, as it should become in an educational institution, a valuable means for the

accomplishment of the very end and aim of the institution itself.

Care is taken to make athletics merely a means of keeping the young men at the School of Mines in the best possible physical condition to do the work for which they came to the institution. While it accomplishes this purpose it naturally fosters and develops a strong college spirit, and this, too, is a species of enthusiasm that is by no means to be despised in the work of educating young men for the activities of their later years.

Athletics are encouraged and fostered in every reasonable way. Football, baseball and basketball teams have been supported at various times and have usually established good records. Excellent tennis facilities are maintained for the use of the students.

STUDENTS' CLUB ROOM

A room in the dormitory 30 by 35 feet in size is fitted up as a Boys' Club Room. It is a general recreation room open at all time to the students of the School of Mines and is under the supervision of the Athletic Association. The room is supplied with furnace heat, an indirect lighting system and contains a piano, reading tables and comfortable chairs. In the future a fire place will be built, which will add to the comfortableness of the room.

The room has a very smooth floor, which has been varnished and waxed, making it excellent for dancing. Several dances are given during the year by the students to their friends.

A dozen or more popular magazines are to be found here, together with the leading engineering magazines and daily newspapers.

Not a more comfortable, cheery or home-like room will be found in any institution in the state.

The fitting up and furnishing of this club room has been made possible by the liberality of the Board of Regents, the generosity of the ladies of Socorro and the excellent co-operation of the student body.

"M" DAY

On the summit of Socorro Mountain, some three miles west of the School of Mines campus, at an elevation of about seven

thousand feet, is located the school emblem. It is a huge block "M," 150 by 110 feet, constructed from boulders on the mountain side and painted white.

Because of its size and height, it can readily be distinguished with the naked eye a distance of more than fifty miles.

Tradition requires that the "M" shall receive annually, at the hands of the Freshman Class, a fresh coat of paint. A day, usually late in the fall, is set aside by the Faculty for this purpose; so that "M" Day is one of the recognized holidays at the School of Mines.

As the painting of the "M" is a rather strenuous task, "M" Day is one which lingers fondly in the memory of every Freshman.

METHOD OF GRADING

The following system of grading is used:

A—Excellent.

B—Good.

C—Fair.

D—Conditioned.

E—Failure.

Inc.—Incomplete.

Grades A, B, and C, carry credits.

D means student has not passed. The condition must be removed by passing a re-examination before the subject is repeated, otherwise it becomes an E. Only one re-examination will be permitted.

E means the subject must be repeated in class. At the discretion of the instructor an incomplete grade, designated "Inc.," may be given the student for failing to finish a course, which must be removed before the subject is repeated in class, otherwise the incomplete becomes a failure.

CONDUCT OF STUDENTS

In the government of the School of Mines the largest liberty consistent with good work is allowed. Students are expected to conduct themselves as gentlemen upon all occasions and to show such respect for law, order, morality, personal honor, and the rights of others as is demanded of good citizenship. It is

also hereby expressly stipulated that the use of intoxicating liquors, whether inside or outside the campus, and the frequenting of places of questionable character are strictly prohibited. It is assumed that the act of registering as a student implies full acceptance of this policy. Failure on the part of any student to comply with this policy will be considered sufficient cause for removal from the institution.

SUMMER WORK

The proximity of the School to mineral properties, mines, and smelters makes it easy for the students to secure employment during the summer and at the same time to acquire much practical experience in the line of his profession. That this advantage has been appreciated is shown by the large proportion of students who yearly make use of this opportunity. During the past year, land-surveying, mine-surveying, geological surveying, assaying and mining, have been attractive fields of work for students during vacation.

CHEMICAL ANALYSIS, ASSAYING AND ORE TESTING

The wide demand which exists in the great mining districts of the Southwest for disinterested and scientific tests and practical investigations has led to the establishment by the New Mexico State School of Mines of a bureau for conducting commercial work relating to mining and metallurgy.

The performance of such work is made possible and accurate results assured by reason of the exceptional facilities of the laboratories of the school and the extensive practical experience of the instructors. The rapidly increasing amount of this work intrusted to the school is sufficient evidence in itself that the plan has been long needed to further the development of the mineral resources of the region.

A special act of the legislature makes provision for carrying on commercial testing. The section from the law governing the School of Mines, Chapter 138, Section 38, Acts of 1899, reads: "The Board of Trustees shall require such compensation for all assays, analysis, mill-tests or other services performed by said institution as it may deem reasonable, and the

same shall be collected and paid into the treasury of the School of Mines." By special resolution it is required that all charges shall be paid in advance. Prices for work will be sent on application.

FREE DETERMINATIONS

For the benefit of prospectors and others, elementary blow-pipe and physical tests will be made of any rocks, ores or other mineralogical material when sent to the school for their proper identification and classification. Such work is done to encourage prospecting and to more fully exploit the mineral resources of New Mexico so little comprehended at the present time. For such work as indicated in this paragraph no charges will be made.

**DIRECTORY OF GRADUATES
AND STUDENTS**

DIRECTORY OF GRADUATES AND STUDENTS†

ARTHUR H. ABERNATHY Socorro, N. M.

Student, 1898-1901. From Pinos, Zacatecas, Mexico. Assayer, Cananea Smelting Works, Cananea, Sonora, Mexico, 1901; Assistant sampler, Cia. Minera de Penoles, Mapimi, Durango, Mexico, 1909-1910; Sampling foreman same company, 1910-1914; Special student at New Mexico School of Mines, 1914-1915; Sampling foreman Cia Minera de Penoles, Mapimi, Durango, Mexico, 1915-1916; Mine foreman, Ozark Mining and Smelting Co., Kelly, New Mexico, 1916-1918; Sampling mill foreman, Cia. Minera de Penoles, Mapimi, Durango, Mexico, 1920.

RAY COOK AHNEFELDT

Riverside, California

(B. S. in Mining Engineering and Civil Engineering, New Mexico School of Mines, 1918)

Enlisted in Engineer Enlisted Reserve Corps, February, 1918; Entered Engineer Officers' Training Camp, Camp Lee, Virginia, May, 1918; Commissioned Second Lieutenant, July, 1918; Died October 9, 1918.

ANTONIO ABEYTA

Socorro, Mexico

(B. S. in Metallurgical Engineering, New Mexico School of Mines, 1914)

Foreman at San Gertrudes Mine, Pachuca, Mexico, 1914-1916; Company I, U. S. Naval Training Station, San Francisco, Calif., 1917-1918; Medical Dept. Navy, 1920—.

EUGENE CARTER ANDERSON

Centreville, Miss.

(B. S. in Mining Engineering, New Mexico School of Mines, 1917.)

Student, 1915-1917; U. S. Reclamation Service, 1917; Sergeant Company E, Twenty-third Regiment, U. S. Engineers, A. E. F., 1917-1919; State Highway Dept., Santa Fe, N. M., 1919—.

ALEXANDER H. ANDREAS, JR.

Laconia, N. H.

Student, 1915-1916, 1919-1921; Assistant Geologist West Indies Oil Company, Caracas, Venezuela, S. A., 1920—.

KATHERINE G. ANGLE

Albuquerque, N. M.

Entered, special student, 1920.

D. S. AMOUR

Terre Haute, Ind.

Entered, special student, 1920.

FLORENTINO BACA

Socorro, New Mexico

Entered Freshman Class, 1919.

†Information concerning former students not here listed or concerning changes of address of those already listed will be gladly received.

- GEORGE C. BAER** Mogollon, New Mexico
(B. S. in Mining Engineering, New Mexico School of Mines, 1910.)
Student, 1907-1910; From Hillsdale, Michigan; Assayer, Tri-Bullion Company, Kelly, New Mexico, 1910; Millman, Socorro Mines Company, Mogollon, New Mexico, 1911; Mill foreman, same company, 1912; Engineer, same company, 1912; Assistant superintendent, same company, 1914-1917; Supt. mines, Matahambre Pina Del Rio, Cuba, 1917—.
- GEORGE BARAN** Cleveland, Ohio
Entered, special student, 1920.
- SIMEON BARNETT** Denver, Colo.
Entered Academic Class, 1920.
- FRED C. BARNARD** New Bedford, Mass.
Entered Freshman Class, 1919.
- SIDNEY S. BARTLETT** Socorro, New Mexico
Entered Freshman Class, 1919.
- PETER A. BALLARD** Rapid City, South Dakota
(B. S. in Mining Engineering, New Mexico School of Mines, 1916.)
Prospecting for oil in Wyoming, 1916-1918; Field geologist Midwest Refining Company. Casper, Wyoming, 1918—.
- JAMES HENRY BATCHELDER, JR.** Socorro, New Mexico
(B. S., New Mexico School of Mines, 1909; E. M., 1910.)
Student, 1906-1910. From Exeter, New Hampshire. Mining, Chloride, New Mexico, 1911; Supt. Highways, Socorro County, New Mexico, 1919. Firm of Batchelder & Ervin, Engineers, Socorro, New Mexico, 1919—.
- THOMAS HORTON BENTLEY** Carneys Point, New Jersey
(B. S., New Mexico School of Mines, 1909; E. M., 1910.)
Student, 1907-1910. From Burro Mountains, New Mexico. Surveyor with Mildon & Russell, Nacozari, Sonora, Mexico, 1910; General engineering work, Hermosillo, Sonora, Mexico, 1911; Mining engineer, Portland, Oregon, 1911; Assistant superintendent, Norton Griffiths Steel Construction Company of London, England, with headquarters at Vancouver, British Columbia, Canada, 1912; Superintendent, same company, with headquarters at Calgary, Alberta, Canada, 1912-1918; E. I. Du Pont De Nemours & Co., 1918-1921—.
- JAMES FIELDING BERRY** Pachuca, Hilogdo, Mexico
Student, 1904-1905. From Socorro, New Mexico. Assayer, American Smelting & Refining Company, Aguascalientes, Mexico, 1905; Assayer, City of Mexico, Mexico, 1906-1907; Chemist, Cia. Metalurgica y Refinadora del Pacifico, Fundician, Sonora, Mexico, 1918; Assistant mine superintendent, American Smelting & Refining Company, Anganguer, Michiocan, Mexico, 1909-1914; Mine superintendent, San Gertrudes Company, Pachuca, Mexico, 1914-1918; Assistant superintendent, same company, 1918-1921—.
- LOUIS AUGUST BERTRAND** Upland Nebraska
Student, 1895-1896. From Conway, Iowa. Student, Ecole Professionalla de l'East, Nancy, Lorraine, 1890-1894; Instructor in Mathematics and French, New Mexico School of Mines, 1905-1906;

Chemist, El Paso Smelting Works, El Paso, Texas; Assayer and surveyor, Consolidated Kansas City Smelting & Refining Company, Chihuahua, Mexico; Superintendent, Carmen Mines, Coahuila, Mexico; Mine superintendent, Cia. Minera de Penoles, Mapimi, Durango, Mexico, 1901-1903.

ALBERT E. BIRCHBY Socorro, New Mexico
Entered Sophomore Class, 1920.

WILLIAM H. BIRCHBY Socorro, New Mexico
Entered Sophomore Class, 1920.

RALPH C. BLACK Dillon, Colo.
Entered Freshman Class, 1920.

ALEXANDER LOUIS BLACKBURN Austin, Texas
(B. S. in Metallurgical Engineering, New Mexico School of Mines, December, 1918.)

Enlisted in Engineer Enlisted Reserve Corps in February, 1918; Student 1915-1918; Mine Surveyor Inspiration Copper Company, Miami, Arizona, 1919; Mine Surveyor, Smuggler Leasing Company, Aspen, Colo., 1919-1920.

CHARLES L. BRADBURY Richmond, Va.
Entered Freshman Class, 1919.

H. LAWRENCE BROWN Los Angeles, California
Student, 1903-1905. From Chicago, Illinois. Positions: Assayer, Ernestine Mining Company, Mogollon, New Mexico; Engineer, Cia. Concheno Beneficiador, Mexico; Mill superintendent, Milwaukee Extraction Company, Phillipsburg, Montana; Engineer, Transvaal Copper Company, Sonora, Mexico; Manager, Morning Star Mining Company, Ophir, Colorado; Manager, San Carlos Mining Company, Sonora, Mexico; Manager of six properties and consulting engineer, Cobalt, Ontario, Canada; Superintendent, Haile Gold Mine, Kershaw, South Carolina; Exploration work in Venezuela, South America; Mill superintendent, National Mining Company, National, Nevada; at present, general manager engineering department American Metal Company, with headquarters in Foster Building, Denver, Colorado.

S. WALTER BURKE San Francisco, California
Entered Freshman Class, 1918.

RAYMOND T. BURKE San Francisco, California
Entered Freshman Class, 1919.

THOMAS BURKE Socorro, New Mexico
Entered Freshman Class, 1920.

W. FRANCIS BUTLER Frankfort, Kansas
Entered Freshman Class, 1919.

FRANK C. BURGESS Socorro, New Mexico
Entered Sophomore Class, 1920.

PHILLIPE A. CAMPREDON Socorro, New Mexico
(B. S. in Metallurgical Engineering, New Mexico School of Mines, 1914.)

Assayer for Shannon Copper Company, Metcalf, Arizona, 1915-1916; Postgraduate work Michigan College of Mines, 1916-1917; Chief engineer Shannon Copper Company, Gleason, Arizona, 1917-1918; Entered U. S. Army in June, 1918; Commissioned Second Lieutenant U. S. Engineers; Discharged December, 1918. With firm of H. Chambon Estate, Socorro, New Mexico, 1919—.

FRANCISCO URENA CAMPOY

Montezuma, Colo.

Entered, special student, 1920.

JAMES F. CANNON

Roswell, New Mexico

Entered Freshman Class, 1919.

PETER EDWARD CANNON

Roswell, New Mexico

Student, 1916-1918 and 1919-1921. B. S. in General Science, May, 1921.

CHARLES H. CAREY

Yakima, Wash.

Entered Academic Class, 1921.

***R. HARLAND CASE**

Deming, New Mexico

Student, 1902-1905. From Cerrillos, New Mexico. Chemist, Compania Metalurgica de Torreon Coahuila, Mexico, 1905-1906; Assistant superintendent, Bonanza Mines, Zacatecas, Mexico, 1906; Assistant manager, Stephenson-Bennett Mining and Milling Company, Organ, New Mexico, 1906-1907; Consulting engineer, Western Mining, Milling & Leasing Company, Colorado Springs, Colorado, 1907-1908; Mining engineer, Deming, New Mexico.

KENNETH J. CHAPMAN

Lodi, California

Entered Freshman Class, 1919.

CARL HARRY CHELLSON

Schenectady, New York

Entered Freshman Class, 1919.

VIVIAN V. CLARK

Tucson, Arizona

Student, 1896-1898. From Kelly, New Mexico. Assayer, Bland Mining Company, Bland, New Mexico, 1898-1899; Superintendent, Navajo Gold Mining Company, Bland, New Mexico, 1900; Manager, Higuera's Gold Mining Company, Sinaloa, Mexico, 1901; Mine operator, Albuquerque, New Mexico, 1902; Manager Bunker Hill Mining and Smelting Company, Reiter, Washington, 1903-1908; Consulting engineer, Consolidated Exploration Mines Company of New York, and allied syndicates, 1909-1910; President, Northern Engineering Company, Seattle, Washington, 1910-1912; President, Clark Mining Machinery Company, successors to Northern Engineering Company, Seattle, Washington, 1912-1916; Consulting work, Tucson, Arizona, 1916-1921—.

DAVID JOSHUE CLOYD

Crown King, Arizona

Student, 1899-1900. From Decatur, Illinois. Chemist and assayer, Wardman's Assay Office, Aguascalientes, Mexico, 1900-1906; Assistant superintendent, Cia. Minera del Tiro General, and assistant superintendent, Cia. del Ferrocarril Central de Potosi, Charcas, San Luis Potosi, Mexico, 1906-1908; Assayer and Chemist,

Dailey, Wisner & Company, Torreon, Coahuila, Mexico, 1908; Chief assayer and chemist, Mazapil Copper Company, Saltillo plant, Saltillo, Coahuila, Mexico, 1911-1913; Superintendent, Bradshaw Reduction Company, Crown King, Arizona, —.

SAMUEL COCKRILL Indianapolis, Indiana
(B. S., New Mexico School of Mines, 1906.)

Student, 1904-1906. From North Fork, Virginia. Post-graduate engineering course, Allis-Chalmers Company, 1907-1908; Milwaukee Coke and Gas Company, Milwaukee, Wisconsin, 1908-1910; Citizens Gas Company, Indianapolis, Indiana, 1910-1921—.

COURTNEY T. COLLINS Socorro, New Mexico
Entered Freshman Class, 1920.

ROBERT R. COOPER Pueblo, Colo.
Entered Freshman Class, 1919.

HENRY A. COOK Arlington, New Jersey
(B. S. in Metallurgical Engineering, New Mexico School of Mines, 1919.)

Student, 1916-1919. Principal of Academic Department, New Mexico School of Mines, 1919-1920; Research chemist, Du Pont Powder Company, Arlington, N. J., 1920-1921—.

WILLIAM H. CLUM Wauwatoosa, Wisconsin
Entered Freshman Class, 1919.

ALLEN E. CRENSHAW Aztec, New Mexico
Entered, special student, 1920.

MARC B. CROWLEY Elkhart, Ind.
Entered Freshman Class, 1920.

MURRELL CULLINS Socorro, New Mexico
Entered Academic Class, 1920.

PHILLIP J. CROSBY Aspen, Colo.
Entered Academic Class, 1920.

GEORGE E. DANLEY Salt Lake City, Utah
Entered Academic Class, 1920.

DARROW, FRANK M. Sutter Creek, California
Entered, special student, 1920.

EARL DAVIS Limona, Fla.
Entered Freshman Class, 1920.

LOUIS A. DILLON Baltimore, Md.
Entered Academic Class, 1920.

WILLARD N. DIXON Santa Fe, New Mexico
Entered Freshman Class, 1919.

LEON DOMINION New York, N. Y.
(B. A., Roberts College, Constantinople, 1896; C. I. M. Mining School University of Liege, 1900.)

Graduate student, 1903-1904. From Constantinople, Turkey. Assistant, United States Geological Survey, 1903; Instructor in Mathematics, New Mexico School of Mines, 1903-1904; Engineer, Victor Fuel & Iron Company, Denver, Colorado, 1904-1906; Superintendent, Bonanza Mine, Zacatecas, Mexico, 1906-1907; Consulting engineer, Mexico City, Mexico, 1908-1909; Consulting engineer, New York City, in care of American Geographic Society, 1910-1921—.

N. PAXTON DOW Decatur, Texas
Entered Freshman Class, 1920.

HENRY C. DRIER Shawano, Wis.
Entered Sophomore Class, 1920

THOMAS J. DUNBAR Pueblo, Colo.
Entered Academic Class, 1920.

JOHN G. EBERT, JR. Red Lion, Pa.
Entered Freshman Class, 1918.

ALEXANDER WALTER EDELEN Mexico City, Mexico
Student, 1905-1906. From Baltimore, Maryland. Assistant superintendent, Elkton Consolidated Mining & Milling Company, Elkton, Colorado, 1906-1907; Superintendent Bonanza Mine, Zacatecas, Mexico, 1907-1908; Superintendent, American Smelting & Refining Company, Angangueounit, Michiocan, Mexico, 1909-1921—.

WALTER R. ESTES Boston, Mass.
Entered Freshman Class, 1919.

THADDEUS BELL EVERHART Socorro, New Mexico
Student, 1905-1907. From Bells, Texas. Assayer and surveyor, Pereguina Mining and Milling Company, Guanajueto, Mexico, 1907-1908; Mill superintendent, Las Animas Mining and Milling Company, Pueblo Nuevo, Durango, Mexico, 1908-1910; Mining, Chlo-ride, New Mexico, 1911-1913; Mining engineer, Socorro, New Mexico, 1914-1921—.

EUGENE E. FOREMAN Endeavor, Pa.
Entered Freshman Class, 1920.

LEOPOLD E. FLEISSNER Milwaukee, Wis.
(B. S., E. M. in Mining Geology, New Mexico School of Mines, 1912.)
Student, 1910-1912. From Manistee, Michigan. Engineer, Sterling Engineering & Construction Company, Milwaukee, Wisconsin, 1912-1913; Engineer, Ray Consolidated Copper Company, Ray, Arizona, 1913-1917; Blomesinck Company, general contractors, Chicago, Illinois, 1921—.

FRANK B. FUHR Denver, Colo.
Entered Academic Class, 1920.

- THOMAS M. GARDINER** Oakland, Calif.
Entered Freshman Class, 1920.
- GEE H. GENG** Toledo, Ohio
Entered Freshman Class, 1919.
- CARL F. GERTZ** Los Angeles, Calif.
Entered Freshman Class, 1919.
- JOSEPH H. GIRARD** Burnett's Creek, Indiana
Entered Sophomore Class, 1919.
- HARRY THORWALD GOODJOHN** Torreon, Coahuila, Mexico
Student, 1902-1903. From Pittsburg, Texas. Assayer Cia. Metalurgica de Torreon, Torreon, Coahuila, Mexico, 1903-1906; Chief chemist, Minera de Penoles Company, Mapimi, Durango, Mexico, 1906; Chemist and metallurgist, Cia. Minera, Fundidora, y Afinadora, Monterey, Mexico, 1907-1908; Chief chemist, Cia. Metalurgica de Torreon, Torreon, Coahuila, Mexico, 1909—.
- SAMUEL JAMES GORMLEY** Coquimbo, Chili
Student, 1895-1896. From Mt. Vernon, Iowa. Assistant professor of Engineering, New Mexico School of Mines, 1895-1896; Assistant assayer, Anaconda Copper Mining Company, Anaconda, Montana, 1897-1900; Chemist, same company, 1900-1902; Superintendent of sampling works, Washoe Smelting Company, Anaconda, Montana, 1902-1906; Smelter superintendent, Bingham Copper & Gold Mining Company, West Jordan, Utah, 1906-1916; Manager, Ore Trading Company's Smelter, 1916—.
- GERALD U. GREEN** Missouri Valley, Iowa
Entered Freshman Class, -920.
- BUNDY M. GRAY** Gallup, New Mexico
Entered as special student, 1920.
- JAMES J. GLENN** Des Moines, Iowa
Entered Freshman Class, 1920.
- H. W. GRANT** Atchison, Kans.
Entered Freshman Class, 1920.
- RICHARD S. GRIGG** Haddonfield, N. J.
Entered Freshman Class, 1920.
- THOMAS B. HALL** Denver, Colo.
Entered Academic Class, 1920.
- WARD F. HAMM** Cleveland, Ohio
Entered Freshman Class, 1919.

HUGH H. HAMMOCK

Mesilla Park, New Mexico

Entered Freshman Class, 1919.

FRANCIS U. HAMMEL

Socorro, New Mexico

Entered Freshman Class, 1919.

EDWIN CLARENCE HAMMEL

Miami, Arizona

(B. S. in Geological Engineering, New Mexico School of Mines, 1917.)

Student, 1914-1917. Sergeant, U. S. Engineers, 1917-1918; Engineering department Inspiration Copper Company, 1919-1920; Mine Surveyor, El Bordo Mines, San Gertrudes Co., Pachuca, Mexico, 1920; Died December, 2, 1920.

LEMONTE C. HARRIS

Estherville, Iowa

Entered Freshman Class, 1920.

E. E. HENDRICKS

Quemado, New Mexico

Entered Freshman Class, 1920.

JOHN S. HENDERSON

Talequah, Okla.

Entered Academic Class, 1920.

DOROTHY ARDIS HILL

Socorro, New Mexico

Entered Freshman Class, 1919.

VICTOR J. HON

Sheridan, Wyo.

Entered Freshman Class, 1920.

CLARENCE HOFFER

Arlington, N. J.

Entered Freshman Class, 1919.

EDMUND NORRIS HOBART

El Paso, Texas

(B. S. in Mining Engineering and Metallurgical Engineering,
New Mexico School of Mines, 1910.)

Student, 1906-1908; 1909-1910. From Clifton, Arizona. Chemist, Socorro Mines Company, 1909; Chief Sampleman, Shannon Copper Company, Clifton, Arizona, 1910-1911; Assistant surveyor, American Smelting & Refining Company, Angangueo, Michiocoan, Mexico, 1911; Resident engineer, Capistante Mines Group, Mazapil Copper Company, Limited, Concepcion del Oro, Zacatecas, Mexico, 1912; Chief engineer, Charcas Unit, American Smelting & Refining Company, Charcas, San Luis Potosi, Mexico, 1913-1914; Mining engineer, Phelps-Dodge Company, Morenci, Arizona, 1914; Mining engineer, El Paso, Texas, 1915; Assistant State Engineer of New Mexico, 1917-1919; Consulting Mining Engineer, El Paso, Texas, and Mexico City, Mexico, 1920.

CARL JOHN HOMME

Marshfield, Oregon

(A. B., St. Olaf College.)

Graduate student, 1899-1910. From Wittenburg, Wisconsin. Assayer and chemist, Candelaria Mining Company, El Paso, Texas, 1900-1901; Assistant superintendent, Gulf Creek Mining Company, Gulf Creek, New South Wales, Australia, 1902; Assayer, Glendale, Oregon, 1909-1913; Dispatching clerk in postoffice, 1915—.

WILLIAM ELIAS HOMME

Glendale, Oregon

(A. B., St. Olaf College.)

Graduate student, 1902-1903. From Wittenburg, Wisconsin. Assayer, Gulf Creek Mining Company, Gulf Creek, New South Wales, Australia, 1903—.

HAYNES A. HOWELL

El Paso, Texas

Student, 1900-1905. From Socorro, New Mexico. Civil engineer on railway from Acapulco, Mexico, 1906-1907; Civil engineer, Mexican Central R. R., 1907-1912; Assistant to state engineer, Santa Fe, New Mexico, 1913-1917; Reclamation service, El Paso, Texas 1917—.

JOHN AUGUST HUNTER

Toledo, Ohio

(B. S., New Mexico School of Mines, 1903.)

Student, 1899-1903. From Socorro, New Mexico. Chemist, Consolidated Kansas City Smelting Company, El Paso, Texas, 1903-1904; Chemist and metallurgist, American Smelting & Refining Company, Aguascalientes, Mexico, 1904-1908; Metallurgist, Congress Mining Company, Congress, Arizona, 1909-1910; Assayer, Los Angeles, California, 1910-1911; Engineer, Pioneer Mining Company, Tucson, Arizona, 1911-1912; Engineer, American Zinc Ore Separator Company, Denver, Colorado, 1912-1914; Mining engineer, Socorro, New Mexico, 1914-1915; Engineer for Cananea Copper Company, 1916; Chemist for By-Product Plant, Toledo, Ohio, 1916-1917; Captain, Second U. S. Engineers, A. E. F., 1917-1919; Construction Engineer, Standard Oil Company, Toledo, Ohio, 1919—.

PABLO INGUNZA

Lima, Peru, S. A.

Entered Freshman Class, 1917.

TOM B. IRVIN

Farmington, New Mexico

Entered Freshman Class, 1920.

JULIUS H. JACKSON

Las Cruces, New Mexico

Entered Academic Class, 1920.

WALLACE S. JACKSON

Portsmouth, N. H.

Entered, special student, 1920.

- ALBIN C. JOHNSON** Ophir, Utah
Entered Freshman Class, 1920.
- FRANK A. JOHNSTON** New Bloomfield, Pa.
Entered, 1911, from New Bloomfield, Pennsylvania. Secured
B. S. degree in Civil Engineering, 1913.
- RALPH WALDO JOHNSTON** Whitinsville, Mass.
Entered Freshman Class, 1919.
- FRANCIS H. JONES** Fairmont, W. Va.
Entered Academic Class, 1920.
- RUEL N. KEEFE** Tulsa, Okla.
Entered, special student, 1920.
- LEON WILLIAM KELLY** Montrose, Pa.
(B. S. in Mining Engineering, New Mexico School of Mines, 1917.)
Student, 1915-1917. Research department, International Smelter
Company, Tooele, Utah, 1917; Second Lieutenant U. S. Infantry,
1817-1918; Research department International Smelter Company,
Tooele, Utah, 1919; Engineer, U. S. Fuel Company, Mohrland, Utah,
1919; Engineer, Utah Fuel Company, Castlegate, Utah, 1920—.
- ELLIOTT G. KEMPTON** Newton Upper Falls, Mass.
Entered Academic Class, 1919.
- JOHN L. KLEINER** Hurley, New Mexico
Entered Freshman Class, 1919.
- JOHN P. KENNEDY, JR.** Natchez, Miss.
Entered Sophomore Class, 1919.
- LAWRENCE J. KING** Philadelphia, Pa.
Entered Freshman Class, 1920.
- FREDERICK KRUG** Jersey City, N. J.
Student, 1917-1918. Assistant electrician, New York and Hon-
duras Rosaria Mining Company, 1917-1918; Instructor Air Ser-
vice School, Carnegie Institute of Technology, Pittsburgh, Pa.,
1918-1919; Electrician, New York and Honduras Rosaria Mining
Company, Honduras, C. A., 1919—.
- FAY G. LECKLIDER** Toledo, Ohio
Entered Freshman Class, 1920.
- JOHN W. LONG** El Paso, Texas
Entered Freshman Class, 1920.

JOHN LUNDBERG

Idaho Falls, Idaho

Entered Academic Class, 1920.

CHARLES THAYER LINCOLN

New York, N. Y.

(B. S., Massachusetts Institute of Technology, 1901.)

Graduate student, 1902-1903. From Boston, Massachusetts. Chemist, Bell Telephone Company, 1901-1902; Assistant in Analytical Chemistry, New Mexico School of Mines, 1902-1903; Acting professor, same, 1903-1904; Instructor in Chemistry, Iowa State University, Iowa City, Iowa, 1904-1905; Chemist, Hartford Laboratory Company, Hartford, Connecticut, 1905-1907; Chemist, Arbuckle Brothers Sugar Refinery, Brooklyn, New York, 1907-1909; Chemist, United States Custom Service, New York, 1910-1921—.

FRANCIS CHURCH LINCOLN

Reno, Nevada

(B. S., Massachusetts Institute of Technology; E. M., New Mexico School of Mines, 1903.)

Assayer, San Bernardino Mining Company, 1900; Chemist, Butterfly Terrible Gold Mining Company, 1900-1901; Professor of Metallurgy, New Mexico School of Mines, 1902-1904; Assistant superintendent, Ruby Gold & Copper Company, Ortiz, Sonora, Mexico, 1904; General manager, Arizona Gold & Copper Company, Patagonia, Arizona, 1904; Professor of Geology, Montana School of Mines, Butte, Montana, 1907-1910; Consulting engineer, New York City, 1910-1911; Assistant professor of Mining, University of Illinois, Urbana, Illinois, 1911-1913; Resident engineer, Bolivian Dev. & Exp. Co., La Paz, Bolivia, 1913-1914; Director Mackay School of Mines, University of Nevada, 1914-1921—.

HORACE T. LYONS

Ajo, Arizona

(B. S. in Mining Engineering, New Mexico School of Mines, 1913.)

Mining Engineer at Miami, Arizona, 1913-1914; First Lieut. Field Artillery Quartermaster's Corps, 1917-1919; Real Estate business, Ajo, Arizona, 1919—.

HARRY C. MAGOON

Chicago, Illinois

Student, 1899-1900. From Chicago, Illinois. Engineer, Illinois Steel Company, Chicago, Illinois, 1911-1921—.

FRANK MALOIT

Hanover, New Mexico

(B. S. in Mining Engineering, New Mexico School of Mines, 1914.)

Mining engineer at Lordsburg, 1914-1915; Acting superintendent, Hanover mine, The Empire Zinc Company, 1918-1921—.

HUGO MAREK, JR.

Socorro, New Mexico

Student, 1916-1918; 1919-1920. Surveyor New Mexico State Highway Department, 1920—.

- LESTER C. MARSH Independence, Mo.
Entered Freshman Class, 1919.
- LEON MASON Toledo, Iowa
Entered Freshman Class, 1919.
- STANLEY MAYER Socorro, New Mexico
Entered Freshman Class, 1919.
- JAMES T. MARTIN ? Bayfield, Colo.
Entered Freshman Class, 1920.
- ROY SYLVESTER McVEIGH Kelly, New Mexico
Student, 1917-1918; Re-entered, 1919.
- JAMES N. McDOUGAL Socorro, New Mexico
Entered Freshman Class, 1920.
- THOMAS N. McDOUGAL Socorro, New Mexico
Entered Freshman Class, 1920.
- DANIEL M. MILLER Lake Valley, New Mexico
(B. S., New Mexico School of Mines, 1909.)
Chemist, Lake Valley Mines Company, Lake Valley, New Mexico; Topographic engineer, U. S. Army—.
- ROY MITCHELL Grinnel, Iowa
Entered Freshman Class, 1919.
- JOSEPH H. MONAHAN Elkhart, Ind.
Entered Freshman Class, 1920.
- OLIVER G. MORROW Banning, Ga.
Entered Academic Class, 1920.
- ABE P. MORRIS Oskaloosa, Iowa
Entered Sophomore Class, 1920.
- TARVER MONTGOMERY Santa Ana, Calif.
Student, 1899-1900. From Santa Ana, California. County surveyor, Orange county, California, 1900-1901; Assistant engineer, Temescal Water Company, Corona, California, 1901; Transitman, San Pedro, Los Angeles & Salt Lake Railroad Company, 1901-1902; Assistant engineer, Pacific Electric Railroad Company, Santa Ana, California, 1902—.
- WILLIAM ESTILL MOORE Bowling Green, Ky.
Student, 1915-1917; Lieutenant, U. S. Aviation Service, A. E. F., 1917-1919; Petroleum Geologist, Bowling Green, Kentucky, 1919—.

EARLE GIBBON MORGAN Guadalajara, Jalisco, Mexico
(E. M., New Mexico School of Mines, 1911.)

Student, 1907-1908, 1910-1911. From Landsowne, Pennsylvania. Pennsylvania State College, 1908-1910; Engineer, Socorro, Mines Company, Mogollon, New Mexico, 1911-1912; Assistant engineer, same company, Guadalajara, Jalisco, Mexico, 1912—.

EARLE D. MORTON Mammoth, Arizona
(E. M. in Mining Geology, New Mexico School of Mines, 1909.)

Student, 1903-1905, 1908-1909. From Los Angeles, California. Assistant superintendent, Giroux Consolidated Mines Company, Kimberly, Nevada, 1905-1906; Washington University, 1906-1907; Mine examiner, Los Angeles, California, 1907-1908; Surveyor, Ampara Mining Company, Etzatlan, Jalisco, Mexico, 1908; Mine superintendent, Arizona & Nevada Copper Company, Luning Nevada, 1909-1910; Mining engineer, Los Angeles, California, 1910; Chief engineer, Lone Mountain Tunnel Company, Superior, Montana, 1911-1912; With Braun Corporation, Los Angeles, California, 1912-1913; Assistant superintendent, Elko-Prince Mining, Gold Circle, Elko County, Nevada; Assistant superintendent, Mammoth mine, Mammoth, Arizona, 1916-1921—.

WILLIAM FREDERICK MURRAY Gallup, New Mexico

Student, 1904-1906. From Raton, New Mexico. In chief engineer's office, Victor Fuel Company, Denver, 1906-1907; Assistant engineer, Victor Fuel Company and Colorado & Southern Railway Company, 1908; Assistant engineer, Hastings Mine, Victor Fuel Company, Hastings, Colorado, 1909-1910; Superintendent, Cass Mine, Victor-American Fuel Company, Delagua, Colorado, 1910-1913; Assistant general superintendent, Victor-American Fuel Company, Gallup, New Mexico, 1913-1921—.

ELLSWORTH H. NEWTON Franklin, New Hampshire
Entered Freshman Class, 1918.

MARTIN J. O'BOYLE Mogollon, New Mexico
(B. S. in Mining Engineering, New Mexico School of Mines, 1914.)
Mining engineer for the Socorro Mines Company, Mogollon, New Mexico, 1914-1921—.

WILLIAM L. O'BRIEN Oakland, Calif.
Entered Freshman Class, 1919.

PATRICK J. O'NEILL Denver, Colo.
Entered, special student, 1920.

N. P. PETERSON Owatonna, Minn.
(B. S. in Metallurgical Engineering, New Mexico School of Mines, 1920.)

Student, 1916-1920; Engineer, Pacific Coast Borax Co., Ryan, California, 1920-1921.

ORESTE PERAGALLO

Tepec, Mexico

(E. M., New Mexico School of Mines, 1918.)

Student, 1907-1908. From Ciudad Juarez, Chihuahua, Mexico. Mining engineer, El Paso, Texas, 1908-1910; Graduate student, New Mexico School of Mines, 1910-1911; Mining engineer, El Paso, Texas, 1911-1912; Chemist, Tepec, Mexico, 1912-1914; Mining engineer, San Diego, California, 1915-1918.

CARL O. REINIUS

Sioux Falls, S. D.

Entered Academic Class, 1921.

WILLIAM F. RHYNE

Chico, Texas

Entered Academic Class, 1921.

ALBERT BRONSON RICHMOND

Tucson, Arizona

Student, 1900-1901. From Las Prietas, Sonora, Mexico. Superintendent, Ramona Mill Company, Gabilan, Sonora, Mexico, 1901-1902; Assayer, Patagonia Sampling Works, Patagonia, Arizona, 1902; Assayer and metallurgist, Patagonia, Arizona; General manager, Mansfield Mining & Smelting Company, Patagonia, Arizona, 1908; Consulting engineer, Tucson, Arizona, 1909; Field engineer, Mines Company of America, with headquarters at Tucson, Arizona, 1910-1921—.

DELL FRANK RIDDELL

Parral, Chihuahua, Mexico

(Ph. C., Chicago College of Pharmacy, 1896; B. S., Nebraska State University, 1901; E. M., New Mexico School of Mines, 1905.)

Graduate student, 1903-1905. From Sioux Falls, South Dakota. Professor of Chemistry, Sioux Falls College, Sioux Falls, South Dakota, 1901-1903; Instructor in Chemistry, New Mexico School of Mines, 1903-1904; Acting professor of assaying, same, 1904-1905; Holder of Allis-Chalmers Scholarship, 1905-1906; Engineer, Universal Pump & Manufacturing Company, Kansas City, Missouri, 1906-1907; Superintendent, Benito Juarez Mine, Parral, Chihuahua, Mexico, 1907-1908; Consulting engineer and acting superintendent, Providentia Mines Company, Parral, Chihuahua, Mexico, 1908-1916; Mine superintendent, Ajo, Arizona, 1916-1921—.

SOREN RINGLUND

Socorro, New Mexico

(B. S. and E. M. in Mining Geology, New Mexico School of Mines, 1912.)

Student, 1910-1912. From Ceresco, Nebraska. Engineer, The Empire Zinc Company, Kelly, New Mexico, 1912-1914; Mining geologist, The Empire Zinc Company, 1915-1918; Enlisted Medical Corps, U. S. Army, July 1, 1918; Died July 24, 1918.

ORLANDO DOUGLAS ROBBINS

Depue, Illinois

(B. S. and E. M., New Mexico School of Mines, 1909.)

Student, 1905-1909. From Louisville, Kentucky. Chemist, El Chino Copper Company, Santa Rita, New Mexico, 1909-1910; Mill superintendent, Germania Mining Company, Springdale, Washington, 1910; Chief sampler, Inspiration Copper Company, Globe, Arizona, 1910; Chief of ore and testing department of Mineral Point Zinc Company, Depue, Illinois, 1914-1921—.

HAROLD E. RODGERS

Tulia, Texas

Entered Freshman Class, 1920.

N. C. B. DERONNE

Nome, Alaska

Entered Sophomore Class, 1921.

PIERRE RONDON

Paris, France

Entered, special student, 1920.

CECIL ROWE

Arden, Nevada

Student, 1917-1921; B. S. in Mining Engineering, May, 1921.

SIGMUND SADOSWKI

Schenectady, N. Y.

Entered Freshman Class, 1920.

JULIUS SANCHEZ

Socorro, New Mexico

(B. S. in Geological Engineering, New Mexico School of Mines, 1917.)

Student, 1912-1914, 1915-1917. Lieutenant, Signal Reserve Corps, U. S. Aviation Service, 1917-1919; Field geologist, Socorro Petroleum Company, Socorro, New Mexico, 1919—.

MANUEL A. SANCHEZ

Mora, New Mexico

(B. S. in Civil Engineering, New Mexico School of Mines, 1917.)

Student, 1914-1917. United States Geological Survey, 1917-1919; Chief State Hydrographer of New Mexico, 1919-1920; Engineer Potosi Mining Co., Chihuahua, Mexico, 1920-1921—.

JAMES R. SHACKLEFORD

Nashville, Tenn.

Entered Academic Class, 1920.

CHARLES S. SHAMEL

Seattle, Washington

(B. S., M. S., University of Illinois; LL. B., University of Michigan; A. M., Ph. D., Columbia University.)

Graduate student, 1901-1902. Mining lawyer, Seattle, Washington.

WALTER SHAWVER

Sandpoint, Idaho

Entered Freshman Class, 1920.

ROBERT O. SHEPARD

San Diego, California

Entered Freshman Class, 1919.

Company. El Paso, Texas, 1912-1917; Assistant superintendent, 1917-1921—.

KARL ASKEL STRAND

Hanover, New Mexico

(B. S. and E. M. in Mining Geology, New Mexico School of Mines, 1912.)

Student, 1906-1912. From Socorro, New Mexico. Ore classifier, Utah Copper Company, Garfield, Utah, 1912; Draughtsman, same, 1912-1913; Mine superintendent, The Empire Zinc Company, Hanover, New Mexico, 1914-1921—.

LEO RICHARD AUGUST SUPPAN

St. Louis, Missouri

(B. S. in Chemistry and Metallurgy, New Mexico School of Mines, 1896.)

Student, 1895-1896. From St. Louis, Missouri. Instructor in Chemistry, New Mexico School of Mines, 1895-1897; Graduate student, Johns Hopkins University, Baltimore, Maryland, 1897; University of Warburg, Germany, 1898; Professor of Chemistry, Marine-Sims College, St. Louis, Missouri, 1898; Associate professor of Pharmaceutical Chemistry, St. Louis, College of Pharmacy, 1913—.

CHESTER L. TALLMADGE

San Antonio, New Mexico

Entered, special student, 1920.

D. A. R. THOMPSON

Worcester, Mass.

Entered, special student, 1920.

OTTO JOSEPH TUSCHKA

Monterey, Nuevo Leon, Mexico

(E. M. in Metallurgical Engineering, New Mexico School of Mines, 1897.)

Student, 1893-1897. From Socorro, New Mexico. Assayer and chemist, Graphic Smelting Works, Magdalena, New Mexico, 1897-1898; Graduate student, New Mexico School of Mines, 1898-1899; Assistant sampling mill foreman, Guggenheim Smelting & Refining Company, Monterey and Aguascalientes, Mexico, 1899-1900; Assayer, Seamon Assay Laboratory, El Paso, Texas, 1900; Chief chemist, Compania Minera, Fundidora, y Afinadora, "Monterey," Monterey, Nuevo Leon, Mexico, 1900-1916; Engineer, Old Dominion Copper Company, 1916-1921.

EDWARD L. VINE

Pueblo, Colo.

Entered Freshman Class, 1919.

GEORGE A. WARNER

Gloucester, Mass.

Entered Freshman Class, 1920.

W. L. WELLMAN

Belen, New Mexico

Entered, special student, 1920.

ACIL C. SHIPPS

Springfield, Illinois

Entered Freshman Class, 1919.

ROBERT L. SHIPLEY

Des Moines, Iowa

Entered Freshman Class, 1920.

THOMAS SIMPSON

Leadville, Colo.

Entered Freshman Class, 1920.

JAMES AVERY SMITH

Smuggler, Colo.

Entered, 1908, from Socorro, New Mexico. B. S. degree in Metallurgical Engineering, 1913; Assayer and sampler, Inspiration Company, Miami, Arizona, 1913-1916; On oil flotation, Smuggler Union Mine, Telluride, Colorado, 1916; Oil flotation engineer in California and at Clifton, Arizona, 1916-1917; Sergeant, Company C, Eighteenth Regiment, U. S. R. R. Engineers, A. E. F., 1917-1919; Flotation engineer, General Engineering Company, Tomboy Mine, Smuggler, Colorado, 1919-1921.

OILVER RUSSELL SMITH

Naches, Washington

(B. S., Kansas College of Agriculture and Mechanic Arts, 1908; C. E., New Mexico School of Mines, 1902.)

Graduate student, 1898-1901. From Manhattan, Kansas. B. S. in Civil Engineering, New Mexico School of Mines, 1902; Assistant in Mathematics and Draughting, New Mexico School of Mines, 1900-1901; Instructor in Engineering and Drawing, same, 1901-1902; Assistant professor in Engineering and Drawing, same, 1902-1903; Assistant surveyor, U. S. General Land Office, 1902; City engineer, Socorro, New Mexico, 1902; Deputy mineral surveyor, U. S. General Land Office, 1903; Professor of Civil Engineering, New Mexico School of Mines, 1903-1907; Civil engineer, Santa Fe Railway, San Bernardino, California, 1907-1908; Engineer United States Reclamation Service, Zillah, Washington, 1908-1921—.

RAYMOND E. SPEARE

Socorro, New Mexico

Entered Freshman Class, 1919.

HOWARD STECH

Rushville, Indiana

Student, 1917-1920; B. S. in Metallurgical Engineering, 1920—. Fellowship in Metallurgy, University of Utah, 1920-1921.

PAUL E. M. STEIN

El Paso, Texas

(B. S., New Mexico School of Mines, 1911; E. M. in Mining Geology, 1912.)

Student, 1907-1912. From Davenport, Iowa. Assistant engineer, Socorro Mines Company, Mogollon, New Mexico, 1912; Chemist, El Paso plant, Kansas City Consolidated Smelting and Mining

FRED G. WEBB

Lay, Colo.

Entered Academic Class, 1920.

LAURENCE P. WELD

Thompson, Nevada

(B. S. and E. M., New Mexico School of Mines, 1912.)

Student, 1908-1912. From Rochester, New York. Concentrator man, Original Amodor Mines Company, Amador City, California, 1912-1913; Assistant engineer and chemist, same company, 1913; Smelter electrician, Mason Valley Mines Company, Thompson, Nevada, 1913—.

MILTON BENHAM WESTCOTT

Monterey, Nuevo Leon, Mexico

Student, 1904-1905. From Chicago, Illinois. Engineering corps, Santa Fe Railway, 1905; Assistant County Surveyor, El Paso county, Texas, 1906-1907; Assistant engineer, Monterey Railway, Light and Power Company, Monterey, Nuevo Leon, Mexico, 1907. Assistant engineer, Monterey Waterworks and Sewer Company, Monterey, Nuevo Leon, Mexico, 1907-1908; Resident engineer, same, 1908-1913; Construction engineer, Nelson, B. C., 1913-1921—.

GEORGE M. WILLIAMSON

Socorro, New Mexico

(M. E., Cornell University, 1914.)

Post-graduate student, 1921.

CHARLES F. WILLIAMS

Mansfield, Ohio

Student, 1914-1915, 1919-1921; B. S. in General Science, May, 1921.

WAKELEY A. WILLIAMS

Grand Forks, B. C., Canada

Student, 1893-1894. From Council Bluffs, Iowa. Assistant superintendent, Granby Consolidated Mining, Smelting and Power Company, Limited, Grand Forks, B. C., Canada, 1898. At present superintendent of same.

DONALD N. WILSON

Toledo, Ohio

Entered Freshman class, 1920.

HOWARD E. WITHERSPOON

Frederick, Okla.

Entered Freshman Class, 1920.

VERNON WINNINGHAM

Portersville, Calif.

Entered Freshman Class, 1919.

D. RALPH YEARY

Morristown, Tenn.

Entered Freshman Class, 1920.

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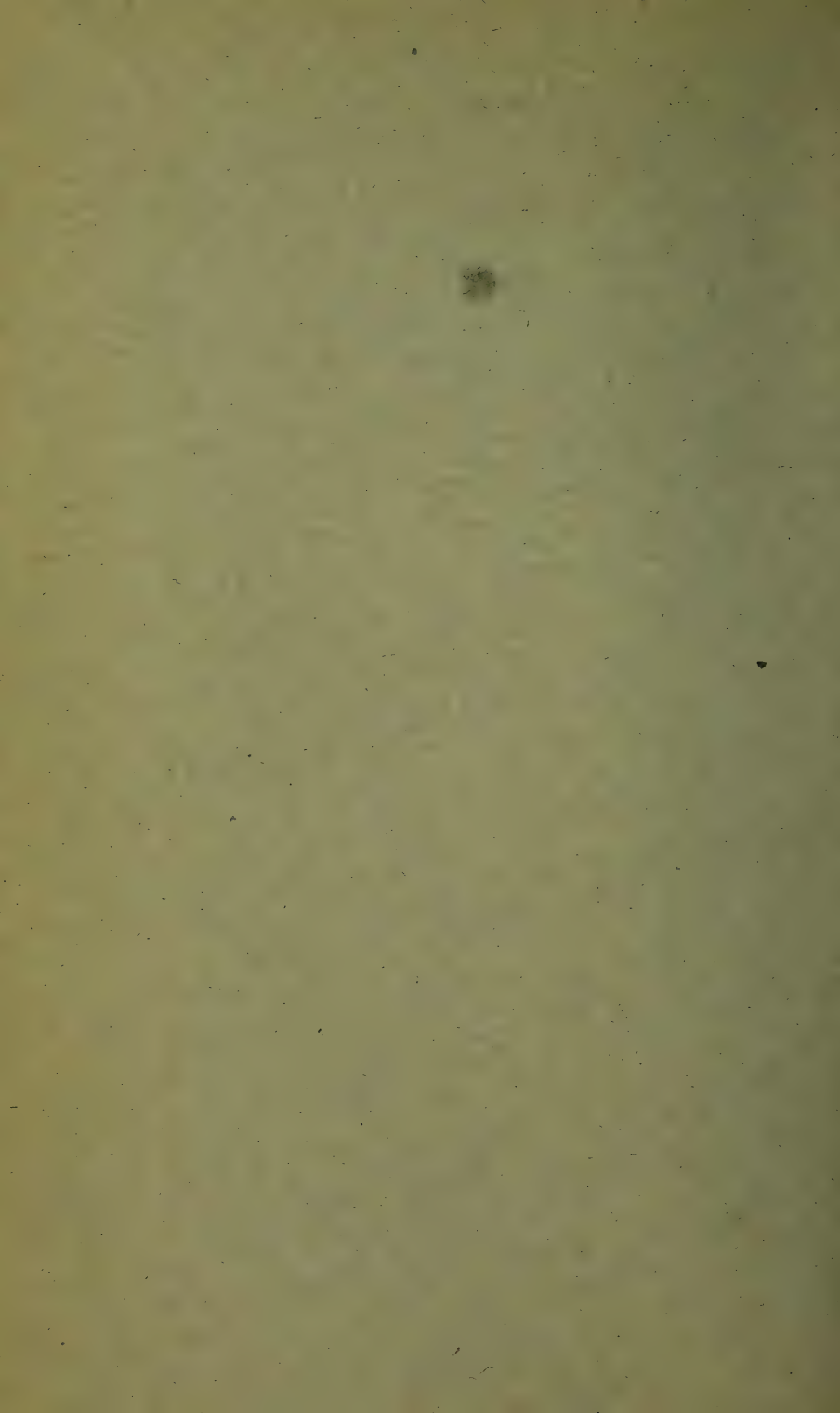
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SOCORRO, N. M.



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FOR 1921-1922

With Announcements for 1922-1923



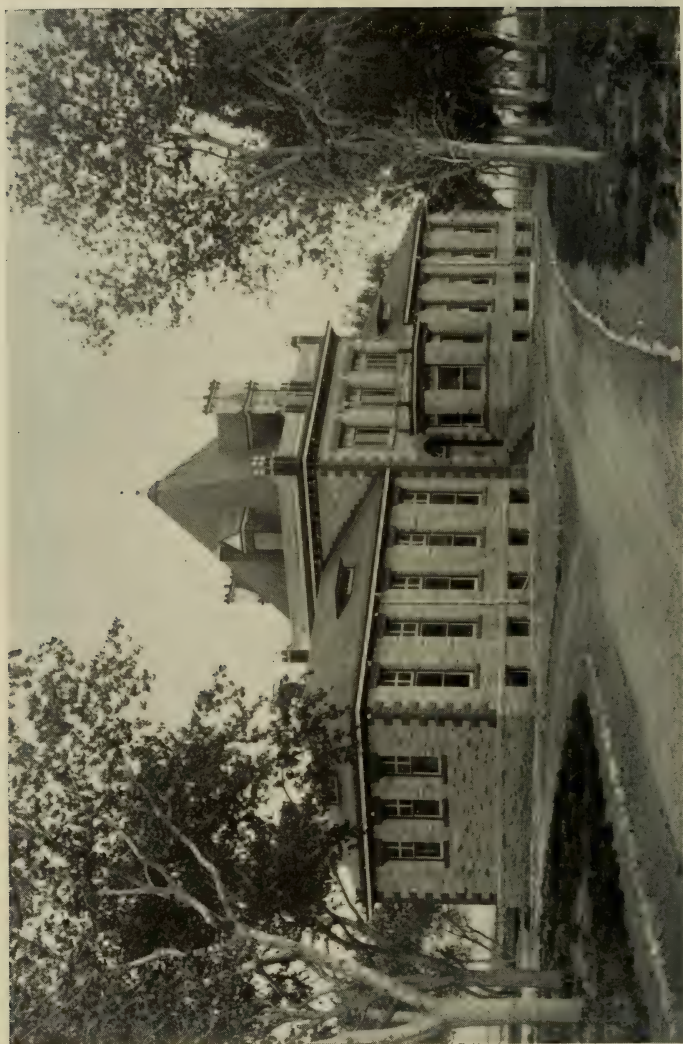
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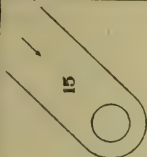
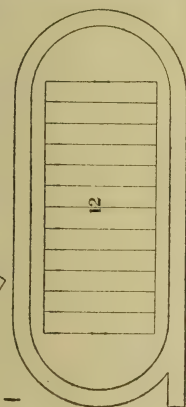
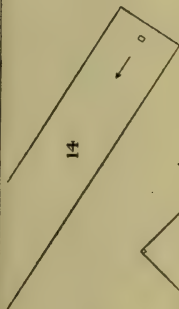
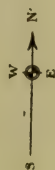


CATALOG
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With Announcements for 1922-1923



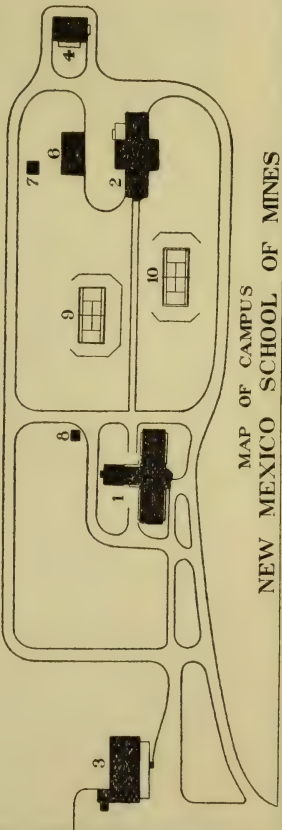
MAIN BUILDING



LEGEND

1. MAIN BUILDING
2. MINING METALLURGY AND MECHANICAL ENGINEERING BUILDING
3. DINDOUL HALL
4. NORTH DORMITORY
5. POWER HOUSE
6. SOUTH DORMITORY
7. CARPENTERS SHOP
8. COKE GRINDING BUILDING
9. TENNIS COURTS
10. SMALL FIELD
11. PORTLAND CEMENT PLANT
12. SWIMMING POOL
13. FAIRWAY—BOCCERIO GOLF CLUB

SCALE 1922



MAP OF CAMPUS NEW MEXICO SCHOOL OF MINES

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SCHOOL CALENDAR

1922

First Semester:

September 12, Tuesday—Registration.

September 13, Wednesday—Class work begins.

October 2, Monday—"M" Day.

November 11, Saturday—Armistice Day, holiday.

November 30, December 1, 2, Thursday, Friday, Saturday—
Thanksgiving holidays.

December 22, Friday, 4 p. m.—Christmas holidays begin.

1923

January 2, Tuesday—School work resumed.

January 17, 18, 19, Wednesday, Thursday, Friday—
Semester Examinations.

Second Semester:

January 23, Tuesday—Registration.

January 24, Wednesday—Class work begins.

February 22, Thursday—Washington's birthday, holiday.

May 14, 15, 16, 17, Monday, Tuesday, Wednesday, Thursday—Senior final examinations.

May 18, Friday,—Commencement.

May 21, 22, 23, Monday, Tuesday, Wednesday—Regular semester examinations.

BOARD OF REGENTS

C. T. BROWN, The Empire Zinc Company.....	Socorro
J. M. SULLY, General Manager Chino Copper Co.	Hurley
CORA E. MOFFETT.....	Socorro
B. H. KINNEY, Manager Kinney Coal Mine.....	Tokay
E. M. SAWYER, Manager Phelps Dodge Corporation...	Tyrone

The complete board is as follows:

HIS EXCELLENCY, M. C. MECHEM, Governor of New Mexico, ex-officio.....	Santa Fe
HON. J. V. CONWAY, Superintendent of Public Instruction, ex-officio	Santa Fe
C. T. BROWN	Socorro
J. M. SULLY	Hurley
CORA E. MOFFETT	Socorro
B. H. KINNEY	Tokay
E. M. SAWYER	Tyrone

OFFICERS OF THE BOARD

C. T. BROWN.....	President
CORA E. MOFFETT.....	Secretary and Treasurer
BLANCHE REED.....	Clerk

FACULTY

- EDGAR HERBERT WELLS.....
.....President and Professor of Geology and Mineralogy
E. M., University of North Dakota.
- RICHARD HERB REECE.....
.....Professor of Mathematics and Physics
M. A., University of Colorado.
- THEODORE WILLIAM QUAYLE.....
.....Professor of Mining and Metallurgy
E. Met., Colorado School of Mines.
- ROY EDGAR BOWMAN.....Professor of Chemistry
B. S. in Chem. Eng., Case School of Applied Science.
- JOHN WILLIAM JOURDAN..Professor of Civil Engineering
B. S. in C. E., Purdue University.
- ELBRIDGE GERRY STUDLEY.....
Professor of English, Academic Instructor, and Athletic
Director.
B. S. in C. E., Purdue University.
- WILLIAM RAMLOW..Assistant Professor of Civil Engineering
E. M., Colorado School of Mines.
- CLARENCE WALTER VAUPELL.....
.....Assistant Professor of Geology and Mineralogy
E. M., Montana State School of Mines.

OTHER EMPLOYEES

- WARD FENTON HAMM.....Student Instructor in Spanish
- RALPH WALDO JOHNSTON.....
.....Student Instructor in Mathematics
- BLANCHE REED.....
.....Registrar and Secretary to the President
- LILLIAN HERKENHOFF.....Matron of the Dormitory
- GEORGE MILLER..Superintendent of Buildings and Grounds

HISTORY AND LOCATION

HISTORICAL SKETCH

The New Mexico School of Mines was created by Act of the Territorial Legislature of 1891. Later in the same year a Board of Regents was appointed and the contract was let for the construction of the present Main Building, which was completed the following year. At that time the support of the School was provided for by an annual tax of one-fifth of a mill on all taxable property in the Territory.

In 1893 a President was elected by the Board of Regents, and classes in Chemistry, Assaying, and Metallurgy were conducted during the school year of 1893 and 1894. At the Session of the Legislature in 1893 a special appropriation of \$31,420 was made to enable the School of Mines to be properly organized.

The School did not attempt to offer a complete mining course until the fall of 1895, the Faculty then consisting of five members. An Act of Congress in that year gave the school about 50,000 acres of land to be used for its support and maintenance.

From the time of its founding until New Mexico was admitted to statehood the tax levy for the support of the School of Mines was steadily increased. The first State Legislature in 1913 made a yearly appropriation of \$22,500 for the School to replace the mill tax levy. The Enabling Act under which New Mexico became a state gave the Institution 150,000 acres of land, bringing the total to more than 200,000 acres. At the present time the School of Mines is supported by legislature appropriations and the income from its state lands.

Driscoll Hall, the main dormitory, was built in 1907. The Engineering Building and the Power House were constructed in 1915-1916. The North Dormitory was first used to accommodate students in 1918.

STATUTES RELATING TO THE SCHOOL

Some of the sections of the Act creating the School of Mines are as follows:

The object of the School of Mines created, established and located by this Act is to furnish facilities for the education of such persons as may desire to receive instruction in chemistry.

metallurgy, mineralogy, geology, mining, milling, engineering, mathematics, mechanics, drawing, the fundamental laws of the United States and the rights and duties of citizenship, and such other courses of study, not including agricultural, as may be prescribed by the Board of Trustees.

The management and control of said School of Mines, the care and preservation of all property of which it shall become possessed, the erection and construction of all buildings necessary for its use, and the disbursement and expenditure of all moneys appropriated by this Act, or which shall otherwise come into its possession, shall be vested in a board of five regents, who shall be qualified voters and owners of real estate; and said regents shall possess the same qualifications, shall be appointed in the same way, and their terms of office shall be the same, vacancies shall be filled in like manner, as is provided in sections 9 and 10 of this Act. Said regents and their successors in office shall constitute a body under the name and style of "The Board of Regents of the New Mexico School of Mines," with right as such of suing and being sued, of contracting and being contracted with, of making and using a common seal and altering the same at pleasure, and of causing all things to be done necessary to carry out the provisions of this Act. A majority of the board shall constitute a quorum for the transaction of business, but a less number may adjourn from time to time.

The board of regents shall have power to confer such degrees and grant such diplomas as are usually conferred and granted by other similar schools.

The regents shall have power to remove any officer, tutor, instructor or employe connected with said School when, in their judgment, the best interests of said School require it.

The board of regents shall require such compensation for all assays, analysis, mill-tests, or other services performed by said institution as they may deem reasonable, and the same shall be collected and paid into the treasury of the School of Mines for said institution, and an accurate account thereof shall be kept in a book provided for that purpose.

LOCATION

The New Mexico School of Mines is located at Socorro on the line of the Atchison, Topeka & Santa Fe Railway connecting Albuquerque, New Mexico, with El Paso, Texas. It is 75 miles south of Albuquerque and 180 miles north of El Paso. From Socorro a branch line of the Santa Fe extends to Magdalena 25 miles to the west.

Socorro is situated in the valley of the Rio Grande on the west bank of the River and two miles east of Socorro Mountain,

the culminating peak of a northward-trending range of hills bounding the river flood-plain on the west.

Socorro is the county seat of Socorro County and has a population of about 2,000 people. Its school system includes a new County High School and several Grade Schools. Religious services are held in Catholic, Presbyterian, Baptist and Episcopal Churches. It supports a bank, a weekly newspaper, electric lighting plant, and various other business organizations. Splendid hotel accommodations are available. The city water supply comes from warm springs near the foot of Socorro Mountain, the water being remarkably pure and unexcelled for domestic use.

TOPOGRAPHY

In the vicinity of Socorro the land bordering the Rio Grande is nearly level, and much of it is under cultivation. Water for irrigation is diverted from the river. To the west the flat valley bottom gives way to gently sloping gravel plains dissected by numerous arroyos leading towards the river. The Socorro Mountain range presents a steep eastward-facing escarpment and a more gradual westerly slope, although nearly all parts of the Mountain are rugged. East of the Rio Grande the sands and gravels of the river flood-plain have developed a semi Bad-land topography.

CLIMATE

The climate of Socorro is dry and mild. New Mexico has been well named the "Sunshine State." The greatest precipitation is in July and August, and in these months a third or more of the total annual rainfall descends. During this short wet season the rains usually occur in the afternoon as showers of short duration but frequently of the cloud-burst type. The yearly precipitation in the Rio Grande valley, which is the driest part of New Mexico, averages under 9 inches.

The average temperature ranges from 37 degrees in January to 78 degrees in July, the annual average being about 58 degrees. Extreme temperatures of either heat or cold are unknown. High winds are frequent in the spring but seldom attain destructive violence. During nearly all of the year the climate is notably pleasant and healthful. Duck hunting is at its best in the Rio Grande valley near Socorro during the month of January. Field work and outdoor sports are engaged in throughout the school year.

BUILDINGS AND GROUNDS

THE CAMPUS

The New Mexico School of Mines Campus contains 32 acres of nearly level ground on the outskirts of the town of Socorro.

MAIN BUILDING

The Main Building is T-shaped, 135 feet long by 100 feet wide, and consists of three stories and a basement. It is constructed of trachyte quarried at Socorro Mountain, and is trimmed with Arizona red sandstone. The building is well ventilated, steam heated, piped for water and gas, and wired for electricity.

On the main floor are located the President's and administrative offices, the mineralogical museum, the quantitative chemistry and mineralogy laboratories, two lecture rooms, and instructors' offices. The mathematics lecture room and instructor's office are on the second floor. The third floor is used as a storage room. The basement contains a lecture room, the physics laboratory, instructor's mineralogical laboratory, qualitative chemistry laboratory, instructor's chemistry laboratory, electro-chemical laboratory, chemical supply rooms, and steam heating plant.

MINING, METALLURGY, AND ENGINEERING BUILDING

The Mining, Metallurgy, and Engineering Building is north of the Main Building. It is a one-story building in the shape of a cross, and is 60 by 120 feet. This structure is built of steel and concrete. It is occupied by the Departments of Mining, Metallurgy, and Civil Engineering. The central part of the building is used for an assay laboratory, ore-dressing plant, and experimental flotation plant. The north wing contains the lecture room, instructor's office, supply room, and balance room of the Department of Mining and Metallurgy. The south wing is occupied by the Civil Engineering Department.

POWER PLANT

The power plant is situated west of the Main Building. It is constructed of reinforced concrete. The dimensions are 34 feet in length by 24 feet in width. Power is furnished by two semi-Diesel Fairbanks-Morse engines and two dynamos.

DRISCOLL HALL

The Main Dormitory, known as Driscoll Hall, is at the south end of the Campus. It is a two-story brick structure with basement below. The building is heated with steam and lighted with electricity. Hot and cold water are available in each room and shower baths are located in the basement. In addition to student rooms it contains a dining room and kitchen and Students' Club Room.

NORTH DORMITORY

At the north end of the Campus is situated the North Dormitory. It is two stories high and has a pebble-dash finish. The rooms have steam heat and electric lights. Bathing facilities are installed on both floors.

LABORATORIES AND EQUIPMENT

CHEMICAL LABORATORIES

The chemical laboratories occupy the entire south wing of the Main Building. Laboratory work in Quantitative Analysis and Mineralogy is conducted in the large laboratory on the main floor. This room is equipped with hoods and twenty-four desks, each of which is supplied with gas and water.

The basement laboratory is fitted with glass partitions and desks. The east half is used for Qualitative Analysis. Hoods are installed at each end of the room, which are supplied with hot plates. Each desk is supplied with a stone sink, gas, and water.

In the west half of the basement chemical laboratory are the instructor's laboratory, electro-chemical laboratory, and balance room. The electro-chemical laboratory is equipped with a Braun six-cell electrolytic outfit by which rapid methods of ore analysis can be performed by the student. Current is supplied by storage batteries, the switch-board being so arranged that any desired voltage and current may be obtained. In the balance room the balances are supported on a solid concrete pier, which is entirely free from vibration.

In addition to apparatus, supplies, and chemicals needed for the courses offered, there is a large stock of pure chemicals and special apparatus, including standardized burettes, flasks, and weights which are used for rock analyses and research work.

All apparatus is loaned to the students. Chemicals and supplies are furnished at cost.

ORE DRESSING EQUIPMENT

The ore dressing equipment consists of both laboratory-sized and full-sized machines. The equipment of laboratory size is used for making tests on a few pounds of ore at a time. It consists of rolls, ball mills, jigs, concentrating table, various types of flotation machines, and a cyanide plant. A flotation plant having a capacity of three tons of ore per day is used to give practical demonstrations in ore dressing during the latter part of the Course. This plant consists of a jaw crusher, ball mill, Deister Plat-o table, and three Callow flotation cells, together with the necessary pumps, blowers, etc. A number of

other ore-dressing machines will be added to the plant in the near future which will add greatly to its efficiency and will greatly increase the methods of ore concentration that can be performed. Several full-sized pieces of ore-dressing machinery have been donated to the school by the Empire Zinc Co., on the recommendation of Mr. C. T. Brown but have not yet been installed. They consist of a Dings Magnetic concentrator, a filter press, Wilfley table and Deister table. The ore dressing equipment is housed in the central section of the Mining, Metallurgy, and Engineering Building.

ASSAY LABORATORY

The assay laboratory occupies the central part of the Mining, Metallurgy, and Engineering Building. The furnaces include several types of gasoline muffle furnaces and a coal-fired muffle furnace. Each student is supplied with a desk containing locker space and boxes for fluxes and other assaying material and supplies.

A weighing room is conveniently located between the furnace room and the lecture room. In the grinding room there are various types of machines for use in the preparation of the samples.

MINERALOGICAL MUSEUM

The mineralogical museum, with instructor's office, occupies the north wing of the first floor of the Main Building. The cases contain many large display minerals and systematic study collections of hand specimens. Numerous mining districts are represented by comprehensive rock and mineral collections. Hundreds of well-developed natural crystals are available; also eight sets of wooden crystal models and one set of celluloid models. One of the large cases contains a set of rocks illustrating structural geology. A good assortment of fossils is included.

MINERALOGICAL LABORATORY

The mineralogical laboratory, on the first floor of the Main Building, is equipped with desks having running water and gas, Jolly balances, and other apparatus necessary to carry on the laboratory work efficiently. An abundant supply of ores and minerals is provided for blowpipe and chemical determinations and for the identification of minerals by their physical characteristics.

PETROGRAPHICAL LABORATORY

For the microscopic study of minerals and rocks, the School has four Bausch and Lomb petrographic microscopes and one Reichert microscope. These are equipped with quartz wedges, one-fourth undulation plates, Bertrand lenses, and all other necessary attachments. The extensive slide collection includes

both oriented sections of many rock-forming minerals and sections of a wide variety of rocks. The rock slides are accompanied by hand specimens for megascopic study. Several thousand labeled rock specimens are available for student use. A Jenks combination grinding and polishing lathe and diamond saw for preparing thin sections and polished surfaces of minerals, rocks, and metals is a part of the equipment.

CIVIL ENGINEERING EQUIPMENT

The School has a full line of transits, levels, and plane tables, representing the various types of instruments manufactured, and a complete assortment of the accessories necessary in solving the ordinary field and drafting room problems in surveying and mapping. All of the equipment is maintained in first class condition, and most of it is new. This year an extra fine transit and several slide rules will be added. The recent addition of a new plane table outfit has greatly improved the student's opportunity for field practice.

DRAFTING ROOM

A well-lighted drafting room is provided in the Engineering Building. Opening from it are the instructors' offices and the supply room. A drawing table and locker facilities are furnished to each student.

PHYSICS LABORATORY EQUIPMENT

The physics laboratory is located in the north basement of the Main Building. It has a substantial cement floor, and is provided with gas and running water.

The laboratory contains the necessary apparatus for illustrating the principal laws and facts of physics; and that necessary for performing the experiments in the laboratory courses accompany courses 201, 202, and 204 as outlined in the Department of Physics.

The importance of electricity in nearly every phase of engineering is recognized. Electricity is supplied to the laboratory from a 20-volt, 160 ampere hour, lead type storage battery; also from the power house direct current at 125 volts, alternating current at 220 volts-3-phase, and alternating current at 110 volts single phase is obtained. The electrical equipment includes: galvanometers, ammeters, voltmeters, wattmeters, integrating meter, rheostats, starting-boxes, circuit-breakers, oil-switches, auto-transformer, $7\frac{1}{2}$ K. W. dynamo which may be run as a generator or as a motor, 2-H. P. 3-phase induction motor of squirrel-cage type, motor-generator of 400 watt capacity, and a recent addition of a Westinghouse Type C W wound rotor, 5 H. P., 3-phase induction motor provided with Type R. F. drum controller for adjustable speed service.

POWER PLANT EQUIPMENT

The equipment of the Power Plant consists of two semi-Diesel Fairbanks-Morse Company engines. The smaller of the two engines delivers about 15 horsepower at full load, and may be belted to an air compressor, or to a direct current dynamo. The compressor is used to store air at a pressure of 120 pounds per square inch for starting the larger engine. This engine is rated at 50 horsepower at full load, is of the vertical type and is directly connected to an alternating current generator. The alternator is a three phase, 440 volt, 60 cycle generator and is capable of delivering 37.5 K. V. A. at full load. This current is transformed to 220 and 110 volts, and distributed to the various buildings as needed. The alternator receives its excitation from a direct current generator which is run from the main shaft of the larger engine. This generator can deliver 40 amperes at 125 volts. The dynamo connected to the smaller engine can deliver 60 amperes at 125 volts.

There are two switchboards, one for the alternating current circuits and one for the direct current circuits. The former was designed and constructed by the Westinghouse Electric Company, and the latter by the General Electric Company. The former contains three panels; an exciter panel, a generator panel, and a feeder panel. The latter contains a single panel. These panels are amply provided with instruments for measuring the power used in the various circuits.

LIBRARIES

A small general library of non-technical books is maintained by the School of Mines. Technical books and other works are kept in the various departmental libraries. They cover thoroughly the fields of mining, metallurgy, geology, mathematics, physics, chemistry, and various branches of engineering.

The following periodicals and publications are received by the School:

Engineering and Mining Journal.

Mining and Scientific Press.

Power.

Engineering News Record.

Chemical and Metallurgical Journal.

Journal of the American Chemical Society.

Journal of Industrial and Engineering Chemistry.

Electrical World.

Chemical Abstracts.

Economic Geology.

Journal of Geology.

Transactions of the American Institute of Mining and Metallurgical Engineers.

All the U. S. Geological Survey Publications.

U. S. Bureau of Mines Publication.

Canadian Geological Survey Publications.

Various daily and weekly papers.

The books, periodicals, etc., of the different department libraries are open daily to the students and the intelligent use of reference works is encouraged by the members of the Faculty.

FIELD WORK AND OBSERVATION TRIPS

ENVIRONMENT

The location of the School of Mines has much to commend it to students specializing in geology and mining. The surrounding country offers a rich fund of varied geological processes and structures. Socorro Mountain, two miles west of the school, is largely a block-faulted mountain, the steep eastward-facing slope being a modified fault scarp. The mountain consists chiefly of volcanic flows and intrusions, but in one section Pennsylvanian and Permian sedimentary rocks and pre-Cambrian greenstone occur. East of the Rio Grande sedimentary rocks predominate. The geologic systems represented include the Pennsylvanian, Permian, Triassic, Cretaceous, Tertiary, and Quaternary. The sparse vegetation, and the thin covering of products of weathering permit the geologic structure to stand out in bold relief.

In the Socorro Mountain Mining District silver has been the dominant metal won. The mines have yielded a production of about three-quarters of a million dollars, but are now idle. The under-ground workings consist of shafts, tunnels, drifts, stopes, winzes, and raises, which are utilized to excellent advantage by the classes in Mine Surveying. The geology and ore deposits present many interesting and instructive features for the classes in Economic Geology and Field Geology. Practical mining procedure can also be studied.

The Kelly District is situated in the Magdalena Mountains, about 25 miles from the School of Mines. It is one of the chief mining districts of New Mexico. In the order of their importance the metals produced are zinc, lead, silver, and copper. The ore deposits are contact-metamorphic and high-temperature deposits. Since their original deposition they have been altered and enriched by atmospheric waters. Mining methods and mining geology are studied to excellent advantage. Modern practice in concentrating complex sulphide ores is illustrated at the Ozark Mill. The district is visited by the Junior and Senior classes from time to time in order to show the practical application of the class-room work.

Coal mines are also readily accessible. In the Carthage District, 20 miles from Socorro, coal mining methods and the geology of coal deposits are illustrated. The coal occurs in rocks of Cretaceous age.

FIELD WORK

Many mining schools are so situated that field work, particularly in Mine Surveying and Geology, cannot be given to advantage during the regular school year. This may be due to a severe winter climate or to the distance to suitable localities or both.

At the New Mexico State School of Mines field work can be carried on throughout the winter months with little interruption on account of cold and stormy weather. The Socorro Mountain mines, which are within walking distance of the School, and the Magdalena and Carthage districts, which are quickly reached by autos, afford splendid opportunities for field practice in mine surveying and geology. Field work in these subjects is scheduled for part of the Saturdays during the regular school year, leaving the summer vacations to be used as the students desire. Field work which can be done on the School campus is arranged for on Saturdays and afternoons of the other week days.

SENIOR TRIP

The senior trip is an annual event at the School of Mines. It requires about a week and is conducted under the supervision of members of the Faculty. The itinerary includes the Chino Copper Company mine at Santa Rita and the concentrating mill of the same company at Hurley, the zinc mine and mill of the Empire Zinc Company at Hanover, the copper mine and mill of the Phelps-Dodge Corporation at Tyrone, the iron mines near Fierro, the silver and lead mines near Silver City, the Lake Valley silver district, and the smelters at El Paso, Texas.

The Chino mine is not only the largest mine in New Mexico, but it is also one of the world's great copper mines. The total amount of ore that eventually will be extracted exceeds 100,000,000 tons with an average copper content per ton of about 1.8 per cent. The ore is mined with steam shovels in open pits. The deposits are intimately connected with a stock of granodiorite and occur both in the granodiorite and in the encircling sedimentary rocks. The ore owes its value largely to supergene chalcocite enrichment. The Chino mill has a capacity of 10,000 tons of ore per day.

At Hanover and Fierro a stock of granodiorite has developed contact metamorphic deposits of zinc and iron in Paleozoic limestones near the contact. The copper deposits at Tyrone consist of large low-grade bodies, which are extracted by underground mining.

By means of the Senior Trip the student is enabled to observe directly a wide variety of mining and metallurgical processes, and he becomes acquainted with mining geology of several types. It is one of the most valuable features of the curricula. Notes taken on the trip are discussed in the succeeding classes.

The trip is made by autos. Students are required to pay for meals and lodgings, but the auto transportation is supplied without charge by the School.

SUMMER WORK

The proximity of the School to mines, mills, and smelters makes it easy for students to secure employment in them during the summer. This practical experience is of great value as a part of an engineering education, and all students are urged to spend one or two summers along these lines. That this advantage has been appreciated is shown by the large proportion of students who yearly accept such work.

SCHOOL OF MINES MINERAL RESOURCES SURVEY OF NEW MEXICO

The Mineral Resources Survey of New Mexico was established by former-President F. A. Jones in 1915. Its object is to encourage the development of the mineral resources of the State. This is done by investigating mineral resources, collecting information regarding mineral deposits and the mining industry, and presenting the information obtained by means of bulletins and personal communications.

The mineral production of New Mexico for 1918 had a total value of about \$41,000,000 of which the metals constituted about \$30,000,000, and the non-metals about \$11,000,000. These figures represent a considerable increase over normal production, due to the stimulus of the Great War and the high prices that prevailed at that time. The total value of mineral products in 1913 was \$17,800,000. Mining is easily the leading industry in New Mexico.

Among the metals mined in the State, copper is by far the most important. Zinc, gold, silver, and lead follow in the order named, and are all produced in notable quantities. Large bodies of iron ore are known, but transportation costs have limited their utilization. Imposing tonnages of manganiferous iron ore have been developed, and manganese deposits are numerous though of small size. Deposits of tungsten and molybdenum have interesting possibilities. Other metals occurring whose value remains to be proved are tin, uranium, vanadium, and radium.

Coal is the leading non-metallic product, and a minor part of the coal mined is converted into coke. The supply of gypsum is inexhaustible. Promising deposits of clay, limestone, building stone, and ornamental stone have been worked. Considerable fluorspar has been recently shipped from the state. Ancient turquoise workings possess considerable historical interest. Minor non-metallic resources include mica, salt, barite, meerschaum, graphite, and alum. Recent drilling has located some promising gas reservoirs, and oil has also been found but not as yet in proved commercial quantities.

The work of the Mineral Resources Survey is necessarily limited because no regular State appropriation has been made for its support. Three bulletins have been published, which are distributed free of charge by the School.

PUBLICATIONS OF THE MINERAL RESOURCES SURVEY OF NEW MEXICO

- Bulletin No. 1. The Mineral Resources of New Mexico, Fayette A. Jones, 1915.
- Bulletin No. 2. Manganese in New Mexico, E. H. Wells, 1918.
- Bulletin No. 3. Oil and Gas Possibilities of the Puertecito District, Socorro and Valencia Counties, New Mexico, E. H. Wells, 1919.

CHEMICAL ANALYSIS, ASSAYING, AND ORE TESTING

This institution makes assays and chemical analyses of ores and other material at prices which correspond with those charged by the commercial assayers of the State. Persons who desire to have such work done will be supplied with a schedule of charges on request. Payment must be made in advance.

The metallurgical and ore dressing equipment makes possible the accurate and reliable testing of ores in small and medium sized lots with the object of determining if they are amenable to any of the current methods of ore treatment. Charges for ore testing vary widely depending on the amount treated and the scope of the investigations. The Act creating the School specifies that charges must be made for such work.

FREE ROCK AND MINERALOGICAL DETERMINATIONS

For the benefit of prospectors and others, examinations of rocks, ores, and other mineralogical material are made, and reports are rendered identifying the material and giving its probable economic importance. No charge is made for work of this kind. Examinations are made by blowpipe, physical, and chemical tests. The identification of small quantities of gold, silver, and platinum in rocks usually requires a regular assay for which a charge is made. The School has a complete oil testing outfit for testing oils and oil shales. Brine samples are tested for potash and bromine.

EXPENSES

MATRICULATION FEE

A matriculation fee of five dollars is required of each student at the time of first registration. This fee is paid but once.

TUITION FEE

The fee for tuition at the New Mexico School of Mines is five dollars a semester or ten dollars a year for residents of New Mexico, and fifteen dollars a semester or thirty dollars a year for non-residents.

ATHLETIC FEE

An athletic fee of three dollars a semester is required of each student and is payable to the Registrar upon registration. This fee is turned over to the treasurer of the Athletic Association. Payment of this fee entitles the student to admittance without charge to all athletic contests on the home grounds, to entertainments given under the auspices of the Athletic Association and to a subscription to the "Gold Pan." Funds obtained from the athletic fees are expended according to the wishes of the Student Body.

LABORATORY FEES

The laboratory fees are intended to cover the cost of materials and other items for which the student does not pay directly and to compensate for the depreciation in the value of the apparatus used. They are as follows:

Phys. 201, Physics	\$4.00
Phys. 202, Physics	4.00
Phys. 203, Direct and Alternating Currents.....	5.00
Chem. 301, General Chemistry	7.50
Chem. 304, Qualitative Analysis	7.50
Chem. 305, Quantitative Analysis	7.50
Chem. 306, Quantitative Analysis	7.50
Chem. 307, Advanced Quantitative Analysis	7.50
Chem. 308, Electro-Analysis	7.50
Chem. 309, Metallurgical Analysis	7.50
Chem. 311, Industrial Chemical Analysis	7.50
Chem. 316, Advanced Qualitative Analysis	7.50
C. E. 406, General Surveying	2.00

C. E. 407, Mine Surveying	2.00
C. E. 408, Topographic Surveying	2.00
C. E. 410, Railroad Surveying	2.00
Geol. 507, Field Geology	5.00
Geol. 508, Applied Geology	5.00
Geol. 509 and 510, Mineralogy (Payment entitles student to permanent possession of Triple Aplanat Lens)	8.00
Geol. 512, Petrology	3.00
Min. 604, Ore Dressing	5.00
Met. 702, Fire Assaying	15.00
Met. 706, Metallurgy of Non-Ferrous Metals	5.00
Met. 713, Metallography	5.00
Academy 915, Elementary Physics	2.00
Academy 920, Elementary Physics	2.00

The number of fees which a student is required to pay varies with the different curricula. A number of the above fees are for special courses. The total for laboratory fees in the Freshman year is \$17.00 and in the Sophomore year \$35.00. Laboratory fees for the Junior year of the Mining Engineering Course amount to \$30.00 and in the Senior year \$20.00. The fees listed include the cost of auto transportation where it is required.

DEPOSITS

A deposit of \$5.00 a semester is required of all students taking laboratory work for which fees are charged. This amount applies on possible breakage or damage to apparatus, and on the cost of supplies required which are not covered by the fees. At the end of the semester any unused balance is refunded.

GRADUATION FEES

Graduation Fees, payable on the delivery of Diploma, are as follows:

Bachelor of Science in Mining Engineering, Metallurgical Engineering, Geological Engineering, or General Science	\$5.00
Mining Engineer, Metallurgical Engineer, or Geological Engineer	\$25.00

LATE REGISTRATION FEE

Students who do not register on the first day of the Semester are charged a special fee for late registration. This amounts to \$2.00 for the first day, and \$.50 for each of the two following days. The maximum amount that can be charged for late registration is \$3.00.

PAYMENT OF FEES

Laboratory fees and deposits are payable at the time of registration, and class attendance cannot begin until payment has been made.

DORMITORY ACCOMMODATIONS

Students are accommodated with board and lodging at the dormitories at the rate of \$30.00 a month, they being required to furnish only their own bed covering. This rate is fixed for cases in which two students occupy the same room. Five dollars a month additional is charged a student who wishes a room by himself, and no student will be accommodated in this way to the exclusion of another student from dormitory privileges. Dormitory charges are required to be paid the first of each month strictly in advance. A deposit of five dollars is required, also, of each student in the dormitories to cover the cost of possible breakage or damage to his room or its furniture. After paying the cost of such damage or breakage, if any, the balance of this fee is returned to the student at the end of the year.

Rooms are assigned to students in the order of application. Dormitory privileges will be withdrawn from any student for boisterous and disorderly conduct in violation of the rules and regulations governing their action, while in or about the building. The privilege of the dormitories is, therefore, for students of good behavior and those who wish to study without being interrupted.

BOOKS AND OTHER SUPPLIES

Books and other supplies for students are furnished through the office at publishers' prices with the freight or express charges added. A considerable saving is thus made in behalf of the student.

TOTAL COST OF ATTENDANCE

The yearly cost of attending the School of Mines varies somewhat. Board and room at the dormitories can be obtained for \$242 a year for the time that the School is in session. The total average yearly cost of tuition, fees, books, and school supplies is \$90 for residents of New Mexico and \$110 for non-residents. The total average necessary expense of attendance is therefore \$332 a year for residents and \$352 for non-residents. These figures do not cover personal expenses such as clothing, amusements, and other items, nor are traveling expenses included. Personal expenses can easily be kept to a small amount, as the temptations to spend money which are numerous in large cities are not common in Socorro.

SCHOLARSHIPS AND AWARDS

INSTRUCTORSHIPS

Two to four Instructorships are provided, carrying free tuition and a salary of \$150 to \$400 per year. These instructorships are awarded only to worthy young men who have satisfactorily completed at least the work of the freshman year. The students holding such instructorships are selected by the President. They are required to give from one to two hours per day to instruction in class-room work, laboratories, or field work.

STATE LEGISLATURE SCHOLARSHIPS

By Act of the Fifth Legislature of the State of New Mexico, each member of the Legislature has the privilege of appointing an indigent student to enter one of the institutions of higher learning in the State, including the School of Mines, for a period of four years. The appointment carries with it an allowance of one hundred dollars a year to apply on actual and necessary expenses while in attendance, in addition to free matriculation and tuition. In case a student appointed does not complete the four years' course another student may be appointed for the unexpired portion of the course. Indigent students who desire to enroll at this Institution are advised to consult with their senators and representatives in regard to possible vacancies in the appointments.

COUNTY SCHOLARSHIPS

Scholarships are open to one student from each county in New Mexico. These scholarships yield free tuition and are awarded by the president to indigent and worthy students.

THE BROWN MEDAL

Beginning with the school year 1922-1923, Mr. C. T. Brown, President of the Board of Regents, will offer annually a gold medal to the member of the Senior Class who ranks highest in scholarship, conduct, and leadership. This medal will be awarded on recommendation of the Faculty at Commencement. Only those students will be eligible who have attended the New Mexico State School of Mines at least two years.

STUDENT ACTIVITIES

ATHLETIC ASSOCIATION

Athletic sports and other student activities at the School of Mines are controlled by the Athletic Association. All students of the School upon payment of the athletic fee become members. The Association elects the staff of the "Gold Pan," the School paper. Officers consist of a President, Vice-president, and a Secretary and Treasurer. A Student Welfare Committee is appointed by the President.

COONEY MINING CLUB

The Cooney Mining Club includes all students of the Institution. It has for its object the presentation to its members of technical and semi-technical information that is not commonly covered in the regular school routine, and it endeavors to bring the students in touch with the mining and allied industries. Under its auspices addresses are given by prominent operators and mining engineers, by members of the faculty, and by advanced students. Motion pictures dealing with mining subjects are frequently exhibited. No dues are required for membership. The Club is affiliated with the American Association of Mining and Metallurgical Engineers, and members are eligible to join this well-known national engineering society at very favorable terms.

ATHLETICS

The importance of physical training in education is appreciated by the New Mexico School of Mines. Athletics are encouraged as a means of keeping the young men attending the school in the best possible physical condition in order that their college work may be done to good advantage and that they may develop the rugged physique so essential in most divisions of engineering work.

The branches of athletics receiving greatest emphasis are football, basketball, baseball, tennis, and swimming. Because of the distance to the nearest schools of equal rank, only limited schedules of intercollegiate games can be arranged. Inter-class contests have proved very popular with the students.

In addition to fields for playing football, baseball, etc., there are two concrete tennis courts and a concrete swimming pool

on the campus. The golf course of the Socorro Golf Club adjoins the campus.

STUDENTS' CLUB ROOM

A large room in the main dormitory is used as a Students' Club Room. It is a general recreation room for the Student Body and is under the supervision of the Athletic Association. Most of the school dances are held here.

The Club Room is tastefully decorated and contains a piano, reading table, leather upholstered chairs and settees, magazine racks, etc. It is illuminated by indirect lighting fixtures. Numerous newspapers, popular magazines and other periodicals are kept in the Club Room for the use of the students.

"M" DAY

The school "M" is a large letter 150 by 110 feet painted in white on the eastward-facing escarpment of Socorro Mountain just below the summit. It is situated about 3 miles west of the school and at an elevation of 7,000 feet. Its size enables it to be distinguished with the naked eye from points as much as 50 miles away.

Tradition requires that the "M" shall receive annually a coat of fresh paint applied by the members of the Freshman Class. A day is designated by the Faculty for this purpose, and "M" day is one of the recognized holidays at the School of Mines.

CONDUCT OF STUDENTS

In the government of the School of Mines the largest liberty consistent with good work is allowed. Students are expected to conduct themselves as gentlemen upon all occasions and to show such respect for law, order, morality, personal honor, and the rights of others as is demanded of good citizenship. It is assumed that the act of registering as a student implies full acceptance of this policy. Failure on the part of any student to comply with it will be considered sufficient cause for removal from the institution.

ORGANIZATION

The New Mexico School of Mines includes the College of Engineering and the Academy.

COLLEGE OF ENGINEERING CURRICULA

In the College of Engineering the following curricula are offered:

- I. Mining Engineering.
- II. Metallurgical Engineering.
- III. Geological Engineering.
- IV. General Science.

The Courses for the first year of all Curricula are the same, and the Courses for Curricula I, II, and III are the same for the second year. This arrangement is an advantage to the student, as it gives him until the beginning of the second or third year to determine which of the four Courses he is best fitted for by aptitude and inclination.

THE ACADEMY

The Academy offers instruction in certain subjects required for entrance to the College of Engineering.

THE COLLEGE OF ENGINEERING

ADMISSION

Admission by Certificate—Graduates of approved high schools of New Mexico and other states or of other schools offering equivalent training are admitted to the regular four-year courses unconditionally if their preparatory subjects include one unit of Algebra, one unit of Plane Geometry, one-half unit of Solid Geometry, two units of English, and one unit of either Elementary Physics, Chemistry, or General Science.

High school graduates who are candidates for admission but who are deficient in one or two of the required subjects specified above are admitted conditionally. The Academy affords an opportunity for the removal of such conditions, and all students thus admitted are expected to make up their deficiencies in the prescribed subjects during their Freshman year.

Admission without Certificate—Candidates for admission who have not graduated from an approved preparatory school are given credit for any high school subjects they have carried satisfactorily. They may be able to make up their deficiencies by taking work in the Academy provided they have nearly completed a regular high school course. Fifteen credits must be obtained, and they must include one unit of Algebra, one unit of Plane Geometry, one-half unit of Solid Geometry, two units of English, and one unit of either Elementary Physics, Chemistry, or General Science.

Candidates who so desire may attempt to obtain credits in any regular preparatory subjects by taking special examinations.

Admission to Advanced Standing.—Students desiring to enter the School of Mines with college credits from other schools should present a copy of their credits, together with a letter of honorable dismissal, to the President. Credit is given for work done in other institutions in so far as it is equivalent to work offered at this school. The amount of credit to be allowed is determined by the department in which similar work is offered.

Soldier Specials.—Veterans of the Great War who are not regularly prepared for college work are offered an opportunity to enter one of the four-year courses provided they can present credits or pass examinations in one unit of Algebra, one unit

of Plane Geometry, one-half unit of Solid Geometry, one unit of a Science, and the equivalent of two years of English. Any part of these credits may be acquired in the Academy. Men entering under the provisions of this section are ranked as regular students only after giving evidence of being able to carry the college work successfully.

Mature Students.—At the discretion of the faculty, students who are more than twenty years of age and who have had considerable practical work in engineering, mining, metallurgy, or geology are permitted to enter the School as candidates for a Degree. Credit must be obtained in one unit of Algebra, one unit of Plane Geometry, one-half unit of Solid Geometry, one unit of a Science, and the equivalent of two years of Preparatory English before the Freshman subjects for which these are prerequisites can be taken.

Special Students.—Many young and mature men who have not been so fortunate as to complete a high school education or who are unable to spend four years in college work desire to obtain some technical training along certain mining, metallurgical, or allied lines. Provision is made whereby such men can register at the school for subjects of the Regular Curricula which they desire to take, without having completed the prerequisites. No credit can be given for work done under these conditions, but the student must give evidence of diligent application to the subjects selected. All fees are the same as for students who are candidates for Degrees.

High-School Units.—One unit for entrance requirements means that a subject has been taken five periods a week for a full school year and that credit has been obtained.

CREDIT HOURS

The amount of credit allowed for the various subjects of the Curricula of the School of Mines is expressed in credit hours. A credit hour is given to one lecture period a week or three laboratory periods a week for one semester. For instance, Course 202 requires three lecture periods and three laboratory periods a week and receives four credit hours.

METHOD OF GRADING

The following system of grading is used:

A—Excellent.

B—Good.

C—Fair.

D—Conditioned.

E—Failure.

Inc.—Incomplete.

Grades A, B, and C, carry credits. A grade of D means that

the work has been below passing and that the student is conditioned. A condition can be removed by passing a condition examination before the subject is repeated, otherwise the grade becomes an E. Only one condition examination in a course is permitted.

An E means a total failure, and the subject must be repeated in class.

An Inc. (incomplete) signifies that the work done in that subject has been fairly satisfactory but has not been completed at the end of the semester. The work required must be completed before the subject is repeated in class or laboratory, or the Inc. becomes an E. If there is a good reason for not removing an Inc. before the subject is repeated, the Instructor may grant an extension of time.

REGULATIONS CONCERNING PREREQUISITES

No student is allowed to register for a subject without having previously completed the prerequisites except on the recommendation of the Instructor and with the approval of the Faculty. College credit is not granted for any subject until the prerequisites have been passed satisfactorily.

REGISTRATION.

Students are required to register for subjects before being admitted to classes, even though college credit is not desired. Changes in registration must be made through the office of the Registrar. Any course discontinued without permission of the Faculty is recorded as a failure. Students are not permitted to take work totaling more than twenty-four credit hours or less than twelve credit hours without the consent of the Faculty.

DEGREES

This Institution confers two classes of degrees: First, the Bachelor of Science degree at the completion of one of the prescribed four-year courses; and second, the degree of Engineer of Mines, Metallurgical Engineer, or Geological Engineer, upon compliance with certain additional requirements.

The degree of Bachelor of Science in Mining Engineering, Metallurgical Engineering, Geological Engineering, or General Science is conferred upon those who, as students of the institution, have completed the corresponding prescribed courses of any one of the several curricula. This degree is also conferred upon those who, as students of this institution, have completed the courses which represent one full year's work in any of the several curricula and have given satisfactory evidence of having previously completed the other courses of that curriculum. Work done at other colleges for a degree may be accepted by the Faculty provided it corresponds to the work

done here, but in each case the Faculty reserves the right to decide whether the previous work has been satisfactory. A candidate for the Bachelor's degree must announce his candidacy at the beginning of the school year at whose termination he expects to receive the degree. This announcement must be in writing and must specify both the curriculum and the degree sought.

The degree of Engineer of Mines, Metallurgical Engineer, or Geological Engineer is conferred upon a graduate of this school who has completed the corresponding undergraduate course; who has done at least two years of successful professional work along that line subsequent to receiving the Bachelor's degree, during one of which he has held a position of responsibility; and who has presented an original and acceptable thesis. The appropriate Engineer's degree is also granted to a graduate of this school who has fulfilled the above scholastic and thesis requirements and who has had at least five years of professional experience along technical lines during one of which he has occupied a position of responsibility.

A candidate for the Engineer's degree should make application for the same on or before January first of the school year in which the degree is to be granted. He should at the same time submit the subject of his thesis, which must be approved by the Faculty. Each thesis must be typewritten on paper eight and one-half by eleven inches, and must be submitted not later than March first. If it is found to be satisfactory the advanced degree will be granted on Commencement day at the end of the school year. A corrected copy of the thesis must be delivered to the President at least two weeks prior to the granting of the degree. It is expected that the thesis in each case shall be prepared with care and shall exhibit sufficient evidence of independent investigation to warrant its publication at the discretion of the faculty.

All degrees are conferred by the Board of Regents upon the recommendation of the Faculty.

CURRICULA

CURRICULUM I. MINING ENGINEERING

The purpose of this Curriculum is to equip the student with the basic principles of the mining business so that he may be able to enter the operating, technical, or administrative phases of the industry. The close relationship existing between mining operations and applied geology is considerably emphasized. In the latter part of the Curriculum an effort is made to present the work from an economic rather than from a purely technical viewpoint.

FRESHMAN YEAR

Course Number	Courses	Periods a week	
		Class	Lab.
First Semester			
101	Algebra	3	
103	Trigonometry	3	
301	General Chemistry	5	6
401	Mechanical Drawing		6
801	English	3	
805	Spanish (Elective)	3	
Second Semester			
104	Analytic Geometry	4	
302	General Chemistry	2	
304	Qualitative Analysis	2	9
402	Descriptive Geometry	1	3
406	General Surveying	2	4
802	English	3	
806	Spanish (elective)	3	

SOPHOMORE YEAR

Course Number	Courses	Periods a week	
		Class	Lab.
First Semester			
105	Calculus	3	
201	Physics	3	3
305	Quantitative Analysis	1	6
407	Mine Surveying and Mapping.....	2	6
501	General Geology	3	1
509	Mineralogy	2	3
807	Spanish (elective)	2	
Second Semester			
106	Calculus	3	
202	Physics	3	3
306	Quantitative Analysis	1	6
408	Topographic Surveying	2	4
502	General Geology	2	1
510	Mineralogy	3	3
808	Spanish (elective)	2	

JUNIOR YEAR

Course Number	Courses	Periods a week	
		Class	Lab.
First Semester			
311	Industrial Chemical Analysis	1	6
403	Machine Drawing		3
411	Mechanics	5	
413	Graphic Statics		3
503	Economic Geology	3	
511	Petrology	1	2
601	Principles of Mining	3	
701	Fire Assaying	1	
703	Principles of Metallurgy	3	
Second Semester			
424	Strength of Materials	3	
426	Hydraulics	2	
504	Economic Geology	4	
602	Principles of Mining	3	
608	Design of Mine Plant		3
610	Mining Law	2	
702	Fire Assaying		6
704	Metallurgy of Iron and Steel	3	

SENIOR YEAR

Course Number	Courses	Periods a week	
		Class	Lab.
First Semester			
409	Pumping	2	
419	Masonry and Concrete Construction.	2	
507	Field Geology	1	8
603	Ore Dressing	2	3
605	Mine Examination		3
607	Mine Administration and Accounts..	2	
705	Metallurgy of Non-Ferrous Metals...	3	
803	English	2	
Second Semester			
204	Direct and Alternating Currents.....	5	3
404	Machine Design		3
422	Heat Power Engineering.....	2	
506	Ore Deposits	2	
604	Ore Dressing	2	3
706	Metallurgy of Non-Ferrous Metals..	3	3
804	English	2	

CURRICULUM II. METALLURGICAL ENGINEERING

The aim of this Curriculum is to give the student a general knowledge of the principles involved in the metallurgy of the more common metals, so that he may be fitted to accept employment in the technical department of any of the various metallurgical plants.

FRESHMAN YEAR

Course Number	Courses	Periods a week	
		Class	Lab.
First Semester			
101	Algebra	3	
103	Trigonometry	3	
301	General Chemistry	5	6
401	Mechanical Drawing		6
801	English	3	
805	Spanish (elective)	3	
Second Semester			
104	Analytic Geometry	4	
302	General Chemistry	2	
304	Qualitative Analysis	2	9
402	Descriptive Geometry	1	3
406	General Surveying	2	4
802	English	3	
806	Spanish (elective)	3	

SOPHOMORE YEAR

Course Number	Courses	Periods a week	
		Class	Lab.
First Semester			
105	Calculus	3	
201	Physics	3	3
305	Quantitative Analysis	1	6
407	Mine Surveying and Mapping.....	2	6
501	General Geology	3	1
509	Mineralogy	2	3
807	Spanish (elective)	2	
Second Semester			
106	Calculus	3	
202	Physics	3	3
306	Quantitative Analysis	1	6
408	Topographic Surveying	2	4
502	General Geology	2	1
510	Mineralogy	3	3
806	Spanish (elective)	3	

JUNIOR YEAR

Course Number	Courses	Periods a week	
		Class	Lab.
	First Semester		
311	Industrial Chemical Analysis.....	1	6
403	Machine Drawing		3
411	Mechanics	5	
413	Graphic Statics		3
503	Economic Geology	3	
511	Petrology	1	2
601	Principles of Mining	3	
701	Fire Assaying	1	
703	Principles of Metallurgy	3	
	Second Semester		
308	Electro-Analysis		6
424	Strength of Materials	3	
426	Hydraulics	2	
504	Economic Geology	4	
602	Principles of Mining	3	
610	Mining Law	2	
702	Fire Assaying		6
704	Metallurgy of Iron and Steel.....	3	
712	Design of Mill Plant		3

SENIOR YEAR

Course Number	Courses	Periods a week	
		Class	Lab.
First Semester			
303	Physical and Theoretical Chemistry..	2	
309	Metallurgical Analysis		8
419	Masonry and Concrete Construction.	2	
603	Ore Dressing	2	3
607	Mine Administration and Accounts..	2	
705	Metallurgy of Non-Ferrous Metals...	3	
709	Metallurgical Calculations	2	
713	Metallography	1	3
803	English	2	
Second Semester			
204	Direct and Alternating Currents....	5	3
404	Machine Design		3
506	Ore Deposits	2	
604	Ore Dressing	2	3
706	Metallurgy of Non-Ferrous Metals...	3	3
714	Electro-Metallurgy	2	
804	English	2	

CURRICULUM III. GEOLOGICAL ENGINEERING

This is intended primarily to give the training necessary in order to follow successfully any of the usual branches of geological work. It also prepares the student to examine and report correctly on prospects and mining properties, and to direct underground prospecting and development work. Attention is given to the geology of oil and gas and the examination of possible oil-bearing areas.

FRESHMAN YEAR

Course Number	Courses	Periods a week	
		Class	Lab.
	First Semester		
101	Algebra	3	
103	Trigonometry	3	
301	General Chemistry	5	6
401	Mechanical Drawing		6
801	English	3	
805	Spanish (elective).....	3	
	Second Semester		
104	Analytic Geometry	4	
302	General Chemistry	2	
304	Qualitative Analysis	2	9
402	Descriptive Geometry	1	3
406	General Surveying	2	4
802	English	3	
806	Spanish (elective)	3	

SOPHOMORE YEAR

Course Number	Courses	Periods a week	
		Class	Lab.
First Semester			
105	Calculus	3	
201	Physics	3	3
305	Quantitative Analysis	1	6
407	Mine Surveying and Mapping	2	6
501	General Geology	3	1
509	Mineralogy	2	3
807	Spanish (elective)	2	
Second Semester			
106	Calculus	3	
202	Physics	3	3
306	Quantitative Analysis	1	6
408	Topographic Surveying	2	4
502	General Geology	2	1
510	Mineralogy	3	3
808	Spanish (elective)	2	

JUNIOR YEAR

Course Number	Courses	Periods a week	
		Class	Lab.
	First Semester		
403	Machine Drawing		3
411	Mechanics	5	
413	Graphic Statics		3
503	Economic Geology	3	
511	Petrology	1	2
515	Advanced Mineralogy	1	3
601	Principles of Mining	3	
701	Fire Assaying	1	
703	Principles of Metallurgy	3	
	Second Semester		
426	Hydraulics	2	
504	Economic Geology	4	
512	Petrography	1	6
602	Principles of Mining	3	
610	Mining Law	2	
702	Fire Assaying		6
708	General Metallurgy	3	

SENIOR YEAR

Course Number	Courses	Periods a week	
		Class	Lab.
	First Semester		
505	Ore Deposits	5	
507	Field Geology	1	8
513	Paleontology	2	3
603	Ore Dressing	2	3
605	Mine Examination		3
607	Mine Administration and Accounts..	2	
803	English	2	
	Second Semester		
204	Direct and Alternating Currents.....	5	3
508	Applied Geology	2	8
514	Oil and Gas Geology	2	
516	Structural and Metamorphic Geology	2	
604	Ore Dressing	2	3
804	English	2	

CURRICULUM IV. GENERAL SCIENCE

The General Science Curriculum does not prepare the student for any specified branch of engineering. A total of 140 credit hours, approximately one-third of which are elective, is required for graduation. The student is thus given an opportunity to acquire a general scientific and engineering education or to specialize along some particular line, according to his inclination. Credit hours are defined on page 33. Credit must be obtained in both semesters of a two-semester subject in order to be counted for graduation.

FRESHMAN YEAR

Course Number	Courses	Periods a week	
		Class	Lab.
First Semester			
101	Algebra	3	
103	Trigonometry	3	
301	General Chemistry	5	6
401	Mechanical Drawing		6
801	English	3	
805	Spanish (elective)	3	
Second Semester			
104	Analytic Geometry	4	
302	General Chemistry	2	
304	Qualitative Analysis	2	9
402	Descriptive Geometry	1	3
406	General Surveying	2	4
802	English	3	
806	Spanish (elective)	3	

SOPHOMORE YEAR

Course Number	Courses	Periods a week	
		Class	Lab.
First Semester			
201	Physics	3	3
305	Quantitative Analysis	1	6
407	Mine Surveying and Mapping	2	6
501	General Geology	3	1
509	Mineralogy	2	3
Electives:			
105	Calculus	3	
807	Spanish	2	
Second Semester			
202	Physics	3	3
306	Quantitative Analysis	1	6
408	Topographic Surveying	2	4
502	General Geology	2	1
510	Mineralogy	3	3
Electives:			
106	Calculus	3	
808	Spanish	2	

JUNIOR YEAR

Course Number	Courses	Periods a week	
		Class	Lab.
	First Semester		
403	Machine Drawings		3
601	Principles of Mining	3	
701	Fire Assaying	1	
703	Principles of Metallurgy	3	
	Electives:		
307	Advanced Quantitative Analysis....		4
309	Metallurgical Analysis		8
311	Industrial Chemical Analysis	1	6
411	Mechanics	5	
413	Graphic Statics		3
503	Economic Geology	3	
511	Petrology	1	2
515	Advanced Mineralogy	1	3
	Second Semester		
602	Principles of Mining	3	
702	Fire Assaying		6
	Electives:		
308	Electro-Analysis		6
316	Advanced Qualitative Analysis		6
410	Railroad Surveying	1	3
424	Strength of Materials	3	
426	Hydraulics	2	
504	Economic Geology	4	
512	Petrography	1	6
608	Design of Mine Plant		3
610	Mining Law	2	
704	Metallurgy of Iron and Steel	3	
708	General Metallurgy	3	
712	Design of Mill Plant		3

SENIOR YEAR

Course Number	Courses	Periods a week	
		Class	Lab.
	First Semester		
803	English	2	
	Electives:		
303	Physical and Theoretical Chemistry.	2	
409	Pumping	2	
419	Masonry and Concrete Construction.	2	
505	Ore Deposits	5	
507	Field Geology	1	8
513	Paleontology	2	3
603	Ore Dressing	2	3
605	Mine Examination		3
607	Mine Administration and Accounts..	2	
705	Metallurgy of Non-Ferrous Metals...	3	
709	Metallurgical Calculations	2	
713	Metallography	1	3

Second Semester			
804	English	2	
	Electives:		
204	Direct and Alternating Currents....	5	3
404	Machine Design		3
422	Heat Power Engineering	3	
506	Ore Deposits	2	
508	Applied Geology	2	8
514	Oil and Gas Geology	2	
516	Structural and Metamorphic Geology	2	
604	Ore Dressing	2	3
706	Metallurgy of Non-Ferrous Metals..	3	3
714	Electro-Metallurgy	2	

DEPARTMENTS OF INSTRUCTION

The Departments of Instruction and the Courses offered are listed on the following pages. Numbers of three figures are used to designate the different courses, of which the first figure indicates the department and the succeeding figures the subject. The department numbers are:

Mathematics 100.

Physics 200.

Chemistry 300.

Civil Engineering 400.

Geology and Mineralogy 500.

Mining 600.

Metallurgy 700.

English and Spanish 800.

Academy 900.

Under each subject are listed the curricula in which it is required, the prerequisites for entrance, the year of the course in which it is offered, the semester in which it is given, the lecture and laboratory periods required per week, and a brief description of the subject matter presented. The curricula are indicated by Roman numerals as given on page 31 of the catalog.

DEPARTMENT OF MATHEMATICS

Professor Reece.

101. COLLEGE ALGEBRA.

Required in I, II, III, and IV.

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, three periods a week.

Theory of exponents; logarithms; algebraic transformations; binomial theorem; proportion; variation; progressions; complex numbers; partial fractions; variables and functions; graphical representation of functions; solution of equations.

103. TRIGONOMETRY.

Required in I, II, III, and IV.

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, three periods a week.

The trigonometric ratios; trigonometric functions; tables; derivation of the principal formulas used in practical and theoretical work; trigonometric identities; circular measure of angles; inverse trigonometric functions; solution of trigonometric equations; solution of triangles; computation of areas; projection; composition and resolution of vector quantities.

104. ANALYTIC GEOMETRY.

Required in I, II, III, and IV.

Prerequisite: Course 103.

Time: Freshman year, second semester.

Lectures, four periods a week.

Rectangular coordinates; graphical representation of functions; the straight line; circle; parabola; ellipse; hyperbola; transformation of co-ordinates; polar co-ordinates; space co-ordinates; space curves; surfaces.

105. CALCULUS.

Required in I, II, and III.

Prerequisite: Course 104.

Time: Sophomore year, first semester.

Lectures, three periods a week.

Limits; derivative of algebraic functions; geometrical and physical interpretation of the derivative; successive differentiation; differentiation of transcendental functions; differentials; rates; maxima and minima of functions; integration; simple applications to problems in geometry, physics, and mechanics.

106. CALCULUS.

Required in I, II, and III.

Prerequisite: Course 105.

Time: Sophomore year, second semester.

Lectures, three periods a week.

This is a continuation of Course 105 and treats of formal integration; use of integral tables; integration as a summation process; successive integration; definite integrals; series; applications.

DEPARTMENT OF PHYSICS

Professor Reece.

201. PHYSICS.

Required in I, II, III, and IV.

Prerequisites: Courses 101 and 103.

Time: Sophomore year, first semester.

Lectures, three periods a week.

Laboratory, three periods a week.

Mechanics of solids, liquids, and gases; heat. The subject is developed in a course of lectures supplemented by text book work.

A laboratory course accompanies the lectures. It is designed primarily to teach the student to make accurate measurements, to give training in the manipulation of instruments employed in physical investigations, and to give practice in properly recording and interpreting experimental data. The experiments include: verniers; micrometer gage; micrometer microscope; composition of forces; resolution of forces; moments; torque; theory of weighing; laws of friction; pulley combinations; falling bodies; acceleration; pendulum; gravitational constant; centrifugal force; harmonic motion; Hooke's law; Young's modulus; specific gravity; density; Boyle's law; thermometry coefficient of expansion; specific heat; latent heat; cooling laws.

202. PHYSICS.

Required in I, II, III, and IV.

Prerequisite: Course 201.

Time: Sophomore year, second semester.

Lectures, three periods a week.

Laboratory, three periods a week.

This course is a continuation of Course 201, and treats of the subjects of magnetism, electricity, and light. Particular stress is placed upon the magnetic, heating, and chemical effects of the electric current; on the distribution of current and potential, in both series and parallel circuits; on the laws of reflection and interference of waves, and the theory of optical instruments.

A laboratory course accompanies the class room work. The experiments include: magnetic fields; strength of magnetic fields; strength of magnets; magnetic effects of currents; chemical effects of currents; electrolysis; heating effects of currents; electromagnets; measurement of current; resistance; electromotive force; condensers; induction; laws of reflection of light; refraction; photometry; spectrum; light waves; polarized light.

204. DIRECT AND ALTERNATING CURRENTS.

Required in I, II, and III.

Prerequisites: Courses 104, 201, and 202.

Time: Senior year, second semester.

Lectures, five periods a week.

Laboratory, three periods a week.

Lectures, discussions and laboratory work on electric circuits, resistance; magnetic circuits; electro-magnets; Ohm's law; measurement of resistance; power; theory and operation of direct current generators and motors; starters and controllers; storage batteries; inductance; capacity; reactance; impedance; power factor; alternators; induction motors; transformers; illumination; practical operation of machines.

DEPARTMENT OF CHEMISTRY

Professor Bowman.

301. GENERAL CHEMISTRY.

Required in I, II, III, and IV.

Prerequisite: Course 301.

Time: Freshman year, first semester.

Lectures, five periods a week.

Laboratory, six periods a week.

This Course is required of all students. The fundamental principles of the science are taught in connection with the descriptive chemistry of the more important non-metals. The lectures are designed to precede the work of the laboratory, in which the student is expected to illustrate and verify the facts and principles which have been discussed in the lectures. Careful manipulation, thoroughness in observation, accuracy in arriving at conclusions, and neatness in note-taking are required of each student.

No previous study of chemistry is required for admission to this course, but the laboratory instruction is so arranged that students who have already spent considerable time upon chemical work in the secondary school are permitted to conduct experiments of a somewhat advanced character, in which the knowledge they have already acquired is utilized.

302. GENERAL CHEMISTRY.

Required in I, II, III, and IV.

Prerequisites: Course 301.

Time: Freshman year, second semester.

Lectures, two periods a week.

A continuation of Course 301, devoted to the chemistry of the metals, particular attention being paid to the reactions employed in analytical chemistry, in metallurgy, and in geology. The knowledge of the laws and theories previously acquired is applied to practical examples as they arise.

303. PHYSICAL AND THEORETICAL CHEMISTRY.

Required in II.

Prerequisite: Course 306.

Time: Senior year, second semester.

Lectures, two periods a week.

The elements of Theoretical Chemistry have already been studied in the course in General Chemistry, Qualitative and Quantitative Analysis. The subject is here pursued more exhaustively. The principal subjects considered are: The gas laws, atomic and molecular weights and the methods of determining them; forms and the phase rule; kinetic theory; thermo-

chemistry; ionization; dissociation; balanced actions; electro-chemistry; and colloids.

304. QUALITATIVE ANALYSIS.

Required in I, II, III, and IV.

Prerequisites: Course 301, accompanied by Course 302.

Time: Freshman year, second semester.

Lectures, two periods a week.

Laboratory, nine periods a week.

The lectures include a through grounding in the principles upon which are based the qualitative separations and the identification of the commoner elements. In the laboratory the student is given practical instruction in manipulation that he may best apply the knowledge gained in the lectures. He is gradually led through the more simple separations to the analysis of alloys, minerals, rocks, slags, and mattes.

305. QUANTITATIVE ANALYSIS.

Required in I, II, III, and IV.

Prerequisite: Course 304.

Time: Sophomore year, first semester.

Lecture, one period a week.

Laboratory, six periods a week.

A Course embodying the general principles of quantitative analysis and introductory to those involving special quantitative methods. In the laboratory the following experiments are performed: The gravimetric determination of chlorine in a soluble chloride; sulphur in a sulphate; iron and aluminum in an ore; calcium and magnesium in limestone, dolomite or an ore; lead, manganese, nickel and zinc in ores; a complete analysis (technical) of a clay.

306. QUANTITATIVE ANALYSIS.

Required in I, II, III, and IV.

Prerequisite: Course 305.

Time: Sophomore year, second semester.

Lecture, one period a week.

Laboratory, six periods a week.

A thoroughly practical Course, largely volumetric, in the determination of the important constituents of ores and metallurgical products. The methods taught are those in use in the large smelters of the West. The student works upon checked samples of widely varying composition until he becomes familiar with the various methods and can carry them out under all conditions with accuracy and rapidity.

Each student is required to analyze ores of the following: Iron, copper, zinc, lead, calcium, manganese, antimony, and arsenic.

307. ADVANCED QUANTITATIVE ANALYSIS.

Elective.

Prerequisite: Course 306.

Time: Junior year, first semester.

Laboratory, four periods a week.

This is an extension of Course 306. The student is permitted some choice in the work to be pursued. It may consist of methods of determination of Molybdenum, Nickel, Tungsten, Uranium, Vanadium and others of the more important commercial alloy metals.

308. ELECTRO-ANALYSIS.

Required in II.

Prerequisite: Course 306.

Time: Junior year, second semester.

Laboratory, six periods a week.

This Course deals with the practical application of the electric current in determining some of the common metals, such as copper, silver, lead and zinc. After the student has become familiar with the methods used for determining each of these, he will use the current in separating mixtures of metals and as a rapid accurate method of ore and alloy analysis.

309. METALLURGICAL ANALYSIS.

Required in II.

Prerequisite: Course 306.

Time: Senior year, first semester.

Laboratory, eight periods a week.

In this course the student may select such of the following as are best suited to his needs: Analysis of rocks and minerals, spiesses, crude and refined lead and copper bullion, spelter, iron and steel, alloys, cement, or the determination of some of the rare elements.

311. INDUSTRIAL CHEMICAL ANALYSIS.

Required in I and II.

Prerequisite: Course 306.

Time: Junior year, first semester.

Lectures, one period a week.

Laboratory, six periods a week.

Lectures are given upon the manufacturing processes closely allied with the Mining and Petroleum Industries, and emphasize their interdependence and interrelation with the Chemical Industry. Acids, alkalis, leaching materials, mineral pigments, explosives, sulfur, salt, phosphates, potash and bromine are discussed. The materials analyzed, consist of boiler water; cement; cyanides; copper by colorimetric methods; copper and

lead by electrolysis; coal; oil and oil shale. Water samples are classified according to the geochemical system of Palmer, and foaming, corrosion, and scale coefficients are determined. Elementary physical tests of cement are made under the supervision of the Department of Civil Engineering.

316. ADVANCED QUALITATIVE ANALYSIS.

Elective.

Prerequisite: Course 304.

Time: Junior year, second semester.

Laboratory, six periods a week.

A Course covering the qualitative tests for the rarer elements, especially those of industrial value.

DEPARTMENT OF CIVIL ENGINEERING

Professor Jourdan.
Assistant Professor Ramlow.

401. MECHANICAL DRAWING.

Required in I, II, III, and IV.

Prerequisites: Entrance Requirements.

Time: Freshman year, first semester.

Laboratory, six periods a week.

This Course involves the use of instruments, geometric construction, and the representation of objects by orthographic and isometric projections. Special attention is given to lettering and the principles of dimensioning.

402. DESCRIPTIVE GEOMETRY.

Required in I, II, III, and IV.

Prerequisite: Course 401.

Time: Freshman year, second semester.

Lectures, one period a week.

Laboratory, three periods a week.

The representation of all geometrical magnitudes is made possible by means of orthographic projections. The student is required to solve various problems involving points, lines, surfaces and solids, and demonstrate them in the drawing room.

403. MACHINE DRAWING.

Required in I, II, III, and IV.

Prerequisite: Course 401.

Time: Junior year, first semester.

Laboratory, three periods a week.

Here the student makes working drawings from machine parts; first, while having the part directly before him, and later, from a freehand sketch without having the part to look at while drawing. Appropriate assignments and lectures are given to cover the principles involved.

404. MACHINE DESIGN.

Required in I and II.

Prerequisites: Courses 401, 402, 403, and 424.

Time: Senior year, second semester.

Laboratory, three periods a week.

This Course involves a study of the design of machine elements and modern machines, and of the nature, strength and action under stress of the materials used in machine construction. Recitations are carried on, including the discussion of problems. In the drafting room each student completes the design of some assigned machine.

406. GENERAL SURVEYING.

Required in I, II, III, and IV.

Prerequisites: Courses 101 and 103.

Time: Freshman year, second semester.

Lectures, two periods a week.

Field Work, four periods a week.

An introductory Course in surveying, including the use, care, and adjustment of instruments; linear and angular measurements with the transit, level, compass and minor instruments. Students are given practice in traversing, computing areas, triangulating, topographic mapping and the keeping of accurate notes.

407. MINE SURVEYING AND MAPPING.

Required in I, II, III, and IV.

Prerequisite: Course 406.

Time: Sophomore year, first semester.

Lectures, two periods a week.

Field Work and Mapping, six periods a week.

This Course involves lectures and recitations on the theory of Mine Surveying as applied both to surface claims and underground workings. An actual survey of a mine and a complete map of the under-ground workings are required of each student. Claim surveys are also made.

408. TOPOGRAPHIC SURVEYING.

Required in I, II, III, and IV.

Prerequisite: Course 406.

Time: Sophomore year, second semester.

Lectures, two periods a week.

Field Work, four periods a week.

This Course deals with the use of the transit and plane table in topographic surveying. Stadia and other methods used in locating topographical features, are employed, and the use of triangulation and base lines is also considered. A complete topographic survey is made and plotted.

409. PUMPING.

Required in I.

Prerequisite: Course 426.

Time: Senior year, first semester.

Lectures, two periods a week.

Part 1. A discussion of pumping, pump problems, and pump details. Types of pumps: Force pumps, crank and flywheel, centrifugal, direct acting, duplex, compound and triple expansion pumps.

Part II. A study of the action of air during compression and expansion; its flow through pipes; and the various types of air compressing and actuating machinery.

410. RAILROAD SURVEYING.

Elective.

Prerequisites: Courses 406 and 408.

Time: Junior year, second semester.

Lectures, one period a week.

Field Work and Drawing, three periods a week.

The Course includes the study of the economic theory of railway location, computation of railway curves, transitions, turn-outs, and earth works. The field work involves preliminary and location surveys, computing, making notes for and locating simple and compound curves.

411. MECHANICS.

Required in I, II, and III.

Prerequisites: Courses 106 and 202.

Time: Junior year, first semester.

Lectures, five periods a week.

This course treats of the composition and resolution of forces, the center of gravity, couples, conditions of equilibrium moment of inertia, flexible cords, rectilinear, curvilinear and rotary motion, work, energy, friction, impact etc. The application of theory in a large variety of problems is emphasized.

413. GRAPHIC STATICS.

Required in I, II, and III.

Prerequisites: Courses 103 and 202.

Time: Junior year, first semester.

Laboratory, three periods a week.

In this subject, graphical methods are applied in finding the stresses in cranes, roof and bridge trusses, mill buildings and other framed structures.

419. MASONRY AND CONCRETE CONSTRUCTION.

Required in I and II.

Prerequisites: Courses 412, 423 accompanying.

Time: Senior year, first semester.

Lectures, two periods a week.

In this Course the attention of the student is directed chiefly toward the use of concrete as a building material. Concrete and other forms of masonry are studied in foundations, piles, retaining walls, dams, buildings and bridges. Practical problems in computation and design are included.

422. HEAT POWER ENGINEERING.

Required in I.

Prerequisites: Courses 411, 201, 202, 301 and 302.

Time: Senior year, second semester.

Lectures, two periods a week.

This Course is devoted to the study of the theory and construction of all heat engines used in modern engineering practice, and is so presented as to give the student a thorough understanding of the essential parts of a steam plant.

424. STRENGTH OF MATERIALS.

Required in I and II.

Prerequisite: Course 411.

Time: Junior year, second semester.

Lectures, three periods a week.

This Course is a study of the stresses and deformation of bodies subjected to tension, compression, shearing, and torsion; the study of elasticity of bodies; stresses in and design of pipes, riveted joints and hooks. It treats of the theory of beams with discussion of bending moments, shearing forces and distribution of stress.

426. HYDRAULICS.

Required in I, II, and III.

Prerequisite: Course 411.

Time: Junior year, second semester.

Lectures, two periods a week.

The study of fluid pressures and the laws governing the flow of water through orifices and pipes, over weirs, in closed conduits and open channels is presented by the liberal use of applied problems. The laws relating to water wheels, turbines, etc., are briefly discussed.

DEPARTMENT OF GEOLOGY AND MINERALOGY

Professor Wells.
Assistant Professor Vaupell.

501. GENERAL GEOLOGY.

Required in I, II, III, and IV.

Prerequisites: Entrance requirements.

Time: Sophomore year, first semester.

Lectures, three periods a week.

Laboratory, one period a week.

Occasional field trips.

This Course is designed to give a thorough foundation on which to base the more advanced geological courses that follow. It consists of lectures, recitations, laboratory work with the common minerals and rocks, the study and interpretation of topographic maps, and occasional excursions into the field.

Dynamic and structural geology are the two branches of the subject receiving the greatest emphasis. The laws and methods of interpretation are discussed with considerable detail, training in the deciphering of geological phenomena being the object sought. The area surrounding Socorro is especially rich in varied and striking geological types. The local geological features are utilized wherever practicable to illustrate the subject matter of the course.

502. GENERAL GEOLOGY.

Required in I, II, III, and IV.

Prerequisite: Course 501.

Time: Sophomore year, second semester.

Lectures, two periods a week.

Laboratory, one period a week.

Historical geology comprises the major portion of the Course. The various eras, periods, and epochs of the earth's history from cosmic to present time are studied in chronological order. The distribution and classification of the sedimentary rocks are taken up and the methods of correlation explained. In the study of the life of the earth during earlier geological eras as recorded by the fossils, special attention is paid to the development of characteristic and predominant forms. Throughout the course those phases of historical geology are emphasized, the understanding of which is essential to the intelligent perusal of geological literature.

The laboratory work includes the study of topographic and geologic maps and some of the geologic folios of the United States Geological Survey.

503. ECONOMIC GEOLOGY.

Required in I, II, and III.

Prerequisites: Courses 501, 502, 509 and 510.

Time: Junior year, first semester.

Lectures, three periods a week.

This Course, together with Course 504, takes up the origin, nature, and occurrence of the economical valuable mineral deposits, both metallic and non-metallic; the various deposits being classified according to their origin rather than their chemical composition. Type forms, especially those developed in the United States, are emphasized. Among the non-metallic deposits studied are coal, oil, gas, cements, gypsum, salt, sulphur, clay, building stones, abrasives, gems, soils, and fertilizers. The study of the metallic ore deposits includes those of iron, copper, lead, zinc, silver, gold, platinum, and minor metals. Many New Mexico deposits are considered.

504. ECONOMIC GEOLOGY.

Required in I, II, and III.

Prerequisite: Course 503.

Time: Junior year, second semester.

Lectures, four periods a week.

In this Course the work outlined in Course 503 is completed. Most of the time is given to a study of the deposits worked for the common and rare metals.

505. ORE DEPOSITS.

Required in III.

Prerequisites: Courses 503 and 504.

Time: Senior year, first semester.

Lectures, five periods a week.

This Course is primarily for Geological Engineers. It consists of a study of deposits of the metallic ores, which are here treated more intensively and in greater detail than is possible in the time allotted to Course 504. The principles of supergene enrichment receive detailed treatment; also their application to the various types of ore deposits. The chemistry and mineralogy of supergene enrichment are considered with the purpose of giving the student sufficient knowledge along these lines to determine whether a given ore deposit is primary or secondary and whether or not it is likely to continue to considerable depth. The important mining districts of the United States which are characterized by supergene enrichment are studied in this connection. A part of the Course is devoted to political and commercial geology.

506. ORE DEPOSITS.

Required in I and II.

Prerequisites: Courses 503 and 504.

Time: Senior Year, second semester.

Lectures, two periods a week.

This Course takes up deposits of the metallic ores, particularly those illustrating supergene enrichment, and the general principles and chemistry of supergene enrichment, as described under Course 505. It is not as comprehensive as the preceding Course because of the smaller amount of time scheduled.

507. FIELD GEOLOGY.

Required in I and III.

Prerequisites: Courses 503, 504, 511, and 408.

Time: Senior year, first semester.

Lectures, one period a week.

Field work, eight periods a week.

Actual field practice comprises the larger part of the work, but a considerable portion of the time is devoted to the writing of reports, office work in the construction of geological maps and sections, and the study of similar maps of the United States Geological Survey. The field work consists both of the rapid mapping of geological formations in large areas and the accurate location and mapping of formation boundaries, faults, vein outcrops, etc., in restricted areas. Practice is given in the use of the plane table and alidade when the party consists of several members, and of the small plane table and the geologist's compass as utilized for geological mapping when no assistant is available. Geological boundaries are also located on topographical maps with the aid of the contours alone. The report required at the end of the course includes the probable geological history, classification of formations, and dominant geological processes illustrated in the area studied, as well as appropriate geological maps.

508. APPLIED GEOLOGY.

Required in III.

Prerequisite: Course 507.

Time: Senior year, second semester.

Lectures, two periods a week.

Field work, eight periods a week.

This Course is designed primarily for students specializing in Geological Engineering. The field work is confined as far as practicable to neighboring mining districts, and includes the study of the features, surface, vein outcrops, structure, faults, underground and surface geological mapping, and the solution of problems dealing with the methods of ore deposition and oc-

currence. The petrographic and chemical examination of rocks and ores collected constitutes a portion of the Course. The work given may be varied in part according to the preference of the student.

509. MINERALOGY.

Required in I, II, III, and IV.

Prerequisites: Courses 301, 302, and 304.

Time: Sophomore year, first semester.

Lectures, two periods a week.

Laboratory, three periods a week.

Crystallography is studied throughout the first semester. Only those phases are emphasized which are of practical value in the determination and proper understanding of minerals, the drill in this portion of the subject being quite thorough. In the laboratory work each student is required to become familiar with the various crystal forms as illustrated by the large number of crystal models and well-developed crystal minerals in the school collection. Proficiency is required in the determination of interfacial angles by means of the contact goniometer and the determination of the crystal form of microscopic crystals by examination with the hand lens.

Practice in the determination of the elements found in minerals accompanies the instruction in crystallography. Blowpipe identifications are emphasized as far as is consistent with dependable results. For those elements which do not give distinctive reactions in blow-pipe analysis, the most satisfactory wet methods of determination are used.

After the completion of the above work the minerals are taken up in systematic order. Over two hundred and fifty of the more common minerals are considered in this and the following Course, stress being placed on their recognition by means of crystal form, cleavage, hardness, specific gravity, luster, and other physical properties. The order of study followed in the lectures is: The elements, sulphides, sulpho-salts, haloids, oxide, aluminates, ferrites, hydroxides, carbonates, phosphates, nitrates, borates, sulphates, tungstates, molybdates, and silicates. The relative values of the minerals, both from the standpoint of economic use and mineralogical significance are emphasized.

510. MINERALOGY.

Required in I, II, III, and IV.

Prerequisite: Course 509.

Time: Sophomore year, second semester.

Lectures, three periods a week.

Laboratory, three periods a week.

The study of the individual minerals begun in Course 509 is here continued. The laboratory work is spent in the determination of the unknown minerals both in the usual form of occurrence and in a powdered condition. Those minerals which cannot be determined by physical characteristics are tested by appropriate blow-pipe and wet methods. The ability to identify the common minerals alone and associated as they are likely to be found in field practice is the aim kept in view.

511. PETROLOGY.

Required in I, II, and III.

Prerequisites: Courses 501, 502, 509, and 510.

Time: Junior year, first semester.

Lectures, one period a week.

Laboratory, two periods a week.

The study of rocks is the purpose of this Course, their origin, history, and classification being emphasized. Rocks are separated into three divisions; igneous, sedimentary, and metamorphic. In the consideration of the different varieties the attention given to each rock is determined by its frequency of occurrence and importance in geological practice. The laboratory work consists of the study and identification of hand specimens.

512. PETROGRAPHY.

Required in III.

Prerequisite: Course 511.

Time: Junior year, second semester.

Lectures, one period a week.

Laboratory, six periods a week.

This is essentially a study of minerals and rocks by means of the petrographic microscope. After the theory and manipulation of the microscope are mastered, oriented thin sections of rock-forming minerals are investigated. The latter part of the Course consists of the study of thin sections of rocks. These are accompanied by hand specimens, enabling the student to compare and confirm megascopic determinations with the more accurate results of microscopic examination. The microscope is also used to unravel the relations of the individual minerals in fine-grained rocks, their order of crystallization, and other characteristics that are not apparent in an examination with the hand lens.

513. PALEONTOLOGY.

Required in III.

Prerequisites: Courses 501 and 502.

Time: Senior year, first semester.

Lectures, two periods a week.

Laboratory, three periods a week.

This course is intended primarily for students specializing in Geological Engineering. The classification of plants and animals and rules of nomenclature are presented. The chief genera and species of fossils are studied, particularly those having considerable value as index fossils. Their preservation, use as stratigraphic indices, means of identification, and importance as rock-forming agents are dealt with.

514. OIL AND GAS GEOLOGY.

Required in III.

Prerequisites: 501, 502, and 511.

Time: Senior year, second semester.

Lectures, two periods a week.

This Course deals with the nature and occurrence of natural gas, petroleum, asphalt, and allied substances. Theories of origin, geologic structures and their relative importance, occurrence, association, migration, and fractionation of petroleum, and natural gas are discussed. The principal oil fields and shale oil areas are studied. Oil prospecting, drilling methods, and valuation of properties are taken up.

515. ADVANCED MINERALOGY.

Required in III.

Prerequisites: Courses 509 and 510.

Time: Junior year, first semester.

Lectures, one period a week.

Laboratory, three periods a week.

A treatment of the physical and crystallographic properties, occurrence, association, and origin of minerals in greater detail than is possible in Courses 509 and 510. Additional species are presented, and gems and gem minerals are considered. Laboratory work consists chiefly of mineralogic determinations by blow-pipe and chemical tests and by the examination of small fragments with the polarizing microscope.

516. STRUCTURAL AND METAMORPHIC GEOLOGY.

Required in III.

Prerequisites: Courses 504 and 511.

Time: Senior year, second semester.

Lectures, two periods a week.

Under the head of Structural Geology, attention is given to joints, fractures, fissures, faults, rock folding and flowage, mountain structure, and isostasy. Fault problems are solved. The Metamorphic Geology presented deals with katamorphism, amamorphism, the metamorphic cycle, and the important features of metamorphism as applied to ore deposits.

DEPARTMENT OF MINING

Professor Quayle.

601. PRINCIPLES OF MINING.

Required in I, II, III, and IV.

Prerequisites: Courses 104, 202, 306, 402 and 502.

Time: Junior year, first semester.

Lectures, three periods a week.

The following subjects are studied:

The classification of mineral deposits from a mining standpoint.

Prospecting by all standard methods.

Excavation of earth and rock, including details of explosives, machine drills, and methods of support.

Tunneling and shaft sinking methods with reference to their relative efficiencies and costs.

Stoping methods and their applicability to various conditions, their effect on surface subsidence, etc.

Surface and underground haulage and transportation systems; types of cars, motive power, track problems, etc.

Hoisting; winding engines, rope, skips, cages, ore pockets, loading, and dumping devices.

Drainage; ventilation; illumination; accident prevention; and safety methods.

602. PRINCIPLES OF MINING.

Required in I, II, III, and IV.

Prerequisite: Course 601.

Time: Junior year, second semester.

Lectures, three periods a week.

This is a continuation of Course 601, and the material presented is listed under that Course.

603. ORE DRESSING.

Required in I, II, and III.

Prerequisites: Courses 104, 202, and 702.

Time: Senior year, first semester.

Lectures, two periods a week.

Laboratory, three periods a week.

This Course together with Course 604 is a detailed study of the processes and machines used in the modern concentrating plants, and includes coarse breakers, fine grinding machines, sizing screens, classifiers, and concentration by gravity, flotation, and electrical machines, and others.

604. ORE DRESSING.

Required in I, II, and III.

Prerequisite: Course 603.

Time: Senior year, second semester.

Lectures, two periods a week.

Laboratory, three periods a week.

This is a continuation of Ore Dressing 603.

605. MINE EXAMINATION.

Required in I and III.

Prerequisites: Courses 407, 408, 504, 512, 602, 702, (507 accompanying).

Time: Senior year, first semester.

Laboratory, three periods a week.

The main object sought in this Course is to train the student sufficiently in expert mine examination work to enable him to report intelligently upon a mining proposition as to the advisability of purchase or of operation. This Course is given in conjunction with the Course in 507, Field Geology.

607. MINE ADMINISTRATION AND ACCOUNTS.

Required in I, II, and III.

Prerequisites: Courses 407, 408, 502, and 602.

Time: Senior year, first semester.

Lectures, two periods a week.

In this Course mining is viewed from the sociological and economic standpoint. Methods employed by the progressive mining companies in dealing with their industrial relations and cost accounting problems are discussed.

608. DESIGN OF MINE PLANT.

Required in I.

Prerequisites: Courses 411, 413, (602, 424, and 426 accompanying).

Time: Junior year, second semester.

Laboratory, three periods a week.

The student is assigned problems relating to a given mine. He makes the requisite surveys, plans the top-works, selects the necessary machinery and designs in detail the particular structure that may be assigned to him, together with specifications, bills of material, and estimates of cost.

610. MINING LAW.

Required in I, II, and III.

Prerequisites: Courses 407 and 502.

Time: Junior year, second semester.

Lectures, two periods a week.

This Course is designed to give the student a working know-

ledge of the mining laws of the United States and of the various states. The statutes are discussed and compared, and leading cases are studied. The mining claim is followed from its inception upon the open unappropriated public domain, through the various steps of discovery, location, development, abandonment, forfeiture and re-location, up to and including the proceedings for patent. Conflicts, interference of claims, cross and uniting lodes extralateral rights, parallel end lines, and similar questions are dealt with.

This course will be devoted primarily to lode claims, but will close with a few lectures on placer claims, millsites, and tunnels.

DEPARTMENT OF METALLURGY

Professor Quayle.

701. FIRE ASSAYING.

Required in I, II, III, and IV.

Prerequisites: Courses 306, 502, and 510.

Time: Junior year, first semester.

Lectures, one period a week.

The instruction in this Course is given by means of lectures in which the methods of handling the various types of ores are considered. This is followed in the second semester by practical work in the laboratory on ores which have been previously accurately assayed. The student is required to assay enough ores of the different types to ensure him of a good working knowledge of fire assaying.

702. FIRE ASSAYING LABORATORY.

Required in I, II, III, and IV.

Prerequisite: Course 701.

Time: Junior year, second semester.

Laboratory, six periods a week.

This Course is the laboratory work of Course 701.

703. PRINCIPLES OF METALLURGY.

Required in I, II, III, and IV.

Prerequisites: Courses 202, 306, and 510.

Time: Junior year, first semester.

Lectures, three periods a week.

A study of the physical and chemical properties of ores and metals as determinants in extraction methods; fuels and thermal measurements; refractory materials; furnaces, their classification and structure; characteristic metallurgical processes and their products; drying and preheating of air for the blast; calculation of chimney draft, etc.

704. METALLURGY OF IRON AND STEEL.

Required in I and II.

Prerequisites: Course 703.

Time: Junior year, second semester.

Lectures, three periods a week.

This Course takes up the metallurgy of iron and steel in detail, in the following order: Specifications of standard iron and steels; ores of iron and the methods of handling them in shipment; the manufacture of pig iron and calculations of blast furnace charges; the manufacture of wrought iron and crucible steel; the Bessemer process; the open-hearth process; the mechanical treatment of steel; the solution theory of iron and steel; the heat treatment of steel.

705. METALLURGY OF THE NON-FERROUS METALS.

Required in I and II.

Prerequisite: Course 704.

Time: Senior year, first semester.

Lectures, three periods a week.

This and the following Course include a study of the metallurgy of copper, lead, zinc, gold and silver.

They are given in the order listed below:

Metallurgy of Gold and Silver.—Placer mining; the patio process; amalgamation in stamp batteries; pan amalgamation; chlorination; cyaniding of sands and slimes; lixivation of silver ores; refining and parting of gold bullion.

Metallurgy of Copper and Lead.—Methods of roasting and details of the roasting furnaces; blast-furnace smelting; reverberatory smelting; Bessemerizing of copper mattes; electrolytic refining of copper; desilverization of base bullion; calculation of furnace charges, etc.

Metallurgy of Zinc.—This treats of the roasting of zinc ores; zinc distillation process; construction and operation of furnaces purification of spelter, etc.

706. METALLURGY OF NON-FERROUS METALS.

Required in I and II.

Prerequisite: Course 705.

Time: Senior year, second semester.

Lectures, three periods a week.

Laboratory, three periods a week.

This Course is a continuation of Course 705.

708. GENERAL METALLURGY.

Required in III.

Prerequisite: Course 703.

Time: Junior year, second semester.

Lectures, three periods a week.

This is a Course designed to give the student taking the Geological Curriculum an insight into the metallurgy of the various metals and covers in a brief manner the material offered in Courses 704, 705 and 706.

709. METALLURGICAL CALCULATIONS.

Required in II.

Prerequisite: Course 704.

Time: Senior year, first semester.

Lectures, two periods a week.

A Course based on Richards' Metallurgical Calculations. It is designed to bring the student in contact with the more im-

portant calculations in connection with the practice of thermochemistry and various smelting operations.

712. DESIGN OF MILL PLANT.

Required in II.

Prerequisites: Courses 411, 413, (602, 424 and 426 accompanying).

Time: Junior year, second semester.

Laboratory, three periods a week.

The student is given certain sections of an ore treatment plant to design in detail. He designs a structure to fit the given requirements, writes the specifications, makes out a bill of material, and makes a cost estimate for the work.

713. METALLOGRAPHY.

Required in II.

Prerequisite: Course 704.

Time: Senior year, first semester.

Lectures, one period a week.

Laboratory, three periods a week.

This Course is a study of the micro-structure of iron and steel, of the non-ferrous metals, and of commercial alloys, and the influence of both heat and mechanical treatment on them.

The laboratory work consists of the preparation and microscopical examination of the various sections; also the construction of the equilibrium diagram of alloys.

714. ELECTRO-METALLURGY.

Required in II.

Prerequisites: Courses 308 and 705.

Time: Senior year, second semester.

Lectures, two periods a week.

A series of lectures are given covering the theory and practical application of the electro-metallurgical processes in use at the present time.

DEPARTMENT OF ENGLISH AND SPANISH

Professor Studley.
Mr. Hamm.

801. ENGLISH.

Required in I, II, III, and IV.

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, three periods a week.

A comprehensive study of grammar and syntax, paying particular attention to their correct and effective employment.

802. ENGLISH.

Required in I, II, III, and IV.

Prerequisite: Course 801.

Time: Freshman year, second semester.

Lectures, three periods a week.

A study of the theory of composition. Much written work is required, and the students are urged to draw their material from along technical lines. The use of effective words and paragraphs is developed by theme study and oral expression.

803. ENGLISH.

Required in I, II, III, and IV.

Prerequisites: Courses 801 and 802.

Time: Senior year, first semester.

Lectures, two periods a week.

A study of the best methods of oral and written exposition of the details and problems of engineering and journalistic writing.

804. ENGLISH.

Required in I, II, III, and IV.

Prerequisites: Courses 801, 802, and 803.

Time: Senior year, second semester.

Lectures, two periods a week.

A continuation of Course 803.

805. SPANISH.

Elective.

Prerequisites: Entrance requirements.

Time: Freshman year, first semester.

Lectures, three periods a week.

Attention is given to the elementary principles of the grammar of the language with the idea of learning the grammar from the language rather than the language from the grammar. Special stress is placed on conversational exercises.

A part of the class exercise each day consists of the cross-translations, both oral and written.

806. SPANISH.

Elective.

Prerequisite: Course 805.

Time: Freshman year, second semester.

Lectures, three periods a week.

A continuation of Course 805. It involves translations, prose writing, and practice in oral expression.

807. SPANISH.

Elective.

Prerequisite: Course 806.

Time: Sophomore year, first semester.

Lectures, two periods a week.

This Course consists almost entirely of Commercial Spanish. Business letter writing, reports, and technical expressions receive special attention. Conversation and sight translation give the student an opportunity of acquiring a good working knowledge of the language.

808. SPANISH.

Elective.

Prerequisite: Course 807.

Time: Sophomore year, second semester.

Lectures, two periods a week.

This Course is a continuation of Course 807.

ACADEMIC DEPARTMENT

Professor Studley.
Mr. Johnston.

The following subjects, specifically prerequisite for admission to the College of Engineering, are regularly offered in the Academy.

901. ELEMENTARY ALGEBRA.

Prerequisite: Entrance into the Academy.

First semester.

Lectures, five periods a week.

A thorough familiarity with the application of the positive-negative concept of number-value to the fundamental operations, to factoring, and to simple equations is developed through constant problem work.

902. ELEMENTARY ALGEBRA.

Prerequisite: Course 901.

Second semester.

Lectures, five periods a week.

The methods of the first semester are continued through the study of fractions, simultaneous equations and graphing, radicals, quadratics, and ratio and proportion.

905. PLANE GEOMETRY.

Prerequisite: Entrance to the Academy.

First semester.

Lectures, five periods a week.

The study of triangles, quadrilaterals, loci, arcs, chords, secants, tangents, and measure of angles is made as interesting as possible through the use of practical problems.

906. PLANE GEOMETRY.

Prerequisite: Course 905.

Second semester.

Lectures, five periods a week.

The methods of the first semester are applied to the study of polygons, the relation of regular polygons and the circle, computation of area, and the solving of various construction problems.

921. SOLID GEOMETRY.

Prerequisites: Plane Geometry, either High School credit or Courses 905 and 906.

First semester.

Lectures, three periods a week.

This work includes the relation of lines and planes in space, properties and measurements of prisms, pyramids, cylinders, cones, the sphere, and the spherical triangle.

915. PHYSICS.

Prerequisite: Entrance to the Academy.

First semester.

Lectures, four periods a week.

Laboratory, three periods a week.

This Course serves as an introduction to applied mathematics and gives the student the fundamentals of physics. In the study of mechanics, heat, and work, attention is given in the laboratory to the computation of data obtained and the manipulation of apparatus.

916. PHYSICS.

Prerequisite: Course 915.

Second semester.

Lectures, three periods a week.

Laboratory, three periods a week.

During the study of sound, light, and electricity, the method of the first semester is followed quite closely. A definite amount of laboratory work is required of each student for credit in the Course.

917. ENGLISH.

Prerequisite: Entrance to the Academy.

First semester.

Lectures, five periods a week.

The purpose of this Course is to give the student a thorough knowledge of the fundamentals of grammar.

918. ENGLISH.

Prerequisite: Course 917.

Second semester.

Lectures, five periods a week.

Syntax and the fundamentals of written and oral composition are stressed this semester.

STUDENTS

SCHOOL YEAR 1921-1922.

SENIOR CLASS

Charles L. Bradbury.....	Richmond, Va.
John P. Kennedy.....	Natchez, Miss.

JUNIOR CLASS

Florentino Baca.....	Socorro, N. M.
Frederick Barnard.....	Socorro, N. M.
Albert E. Birchby.....	Socorro, N. M.
William H. Birchby.....	Socorro, N. M.
Ralph C. Black.....	Dillon, Colo.
Frank C. Burgess.....	Socorro, N. M.
William Francis Butler.....	Socorro, N. M.
Harry C. Chellson.....	Socorro, N. M.
Robert R. Cooper.....	Rush, Colo.
Willard N. Dixon.....	Santa Fe, N. M.
Gee H. Geng.....	Toledo, Ohio
Carl F. Gertz.....	Los Angeles, Calif.
Jo. H. Girard.....	Socorro, N. M.
Ward F. Hamm.....	Socorro, N. M.
Francis U. Hammel.....	Socorro, N. M.
Hugh M. Hammock.....	Mesilla Park, N. M.
Albin C. Johnson.....	Opir, Utah
Ralph W. Johnston.....	Socorro, N. M.
Fay G. Leeklider.....	Socorro, N. M.
Hugo Marek, Jr.....	Socorro, N. M.
Abe P. Morris.....	Socorro, N. M.
Ellsworth H. Newton.....	Socorro, N. M.

(JUNIOR CLASS, Continued)

N. C. B. deRonne.....	Socorro, N. M.
Acil C. Shipps.....	Socorro, N. M.
Thomas Simpson.....	Leadville, Colo.

SOPHOMORE CLASS

Elicium R. Chavez.....	Socorro, N. M.
Courtney T. Collins.....	Socorro, N. M.
Marc B. Crowley.....	Dawson, N. M.
George E. Danley.....	Salt Lake City, Utah
Eugene E. Foreman.....	Socorro, N. M.
Frank B. Fuhr.....	Denver, Colo.
Thomas M. Gardiner.....	Socorro, N. M.
Gerald U. Green.....	Socorro, N. M.
John S. Henderson.....	Ogden, Utah
Victor J. Hon.....	Sheridan, Wyo.
Thomas B. Irvin.....	Farmington, N. M.
William J. Kemnitzer.....	Mill Valley, Calif.
Louis E. Kemnitzer.....	Mill Valley, Calif.
Lawrence J. King.....	Philadelphia, Pa.
John L. Kleiner.....	Silver City, N. M.
Carl O. Reinius.....	Socorro, N. M.
Harold E. Rodgers.....	Socorro, N. M.
Sigmund J. Sadowski.....	Socorro, N. M.
Raymone E. Speare.....	Socorro, N. M.
David A. R. Thompson.....	Worcester, Mass.
George A. Warner.....	Socorro, N. M.
Donald N. Wilson.....	Socorro, N. M.

FRESHMAN CLASS

Fermin C. Albano.....	Belen, N. M.
Raymond G. Brown.....	Arroyo Grande, Calif.

(FRESHMAN CLASS, Continued)

John J. Etter.....	Albuquerque, N. M.
Jack E. Fyfe.....	San Francisco, Calif.
Emil G. Hanson.....	Pomona, Calif.
Julius H. Jackson.....	Socorro, N. M.
Wallace S. Jackson.....	Socorro, N. M.
Lorin L. Hawes.....	Council Bluffs, Ia.
A. E. Larson.....	Racine, Wis.
Thelma G. Means.....	Socorro, N. M.
Lamont E. McGinnis.....	Roswell, N. M.
Marvin M. Moser.....	Jefferson City, Tenn.
Sanborn Nicholas.....	Socorro, N. M.
James R. Shackelford, Jr.....	Nashville, Tenn.
Genevieve Sparks.....	Socorro, N. M.
Robert J. Spink.....	Council Bluffs, Ia.
William J. Staley.....	Portland, Ore.
James Taylor.....	Easterhouse, Scotland
Joe E. Tinguely.....	Socorro, N. M.
Charles J. Tinnin.....	Socorro, N. M.

SPECIAL COURSES

Floyd B. Atkins.....	Socorro, N. M.
Simeon Barnett.....	Socorro, N. M.
F. U. Campoy.....	Bedar, Spain
Walter J. Corley.....	Roswell, N. M.
Phillip J. Crosby.....	Aspen, Colo.
Louis B. Fargo.....	Cuba, N. M.
Bundy M. Gray.....	Socorro, N. M.
Thomas B. Hall.....	Victor, Colo.
William H. Hepplewhite.....	Canon City, Colo.
Richard E. Huberty.....	Leadville, Colo.

(SPECIAL COURSES, Continued)

Frances McGinnis.....	Roswell, N. M.
Pierre Rondon.....	Paris, France
Michael J. Ryan.....	Weymouth, Mass.
Howard N. Skaggs.....	Denver, Colo.
Wallace Todd.....	Alcalde, N. M.
Robert F. Walker.....	Duquense, Pa.
Walter J. Wellman.....	Belen, N. M.
James J. Whalen.....	Socorro, N. M.
Thomas Wilson.....	Albuquerque, N. M.
Joe Zoul.....	Socorro, N. M.

ACADEMIC DEPARTMENT

Arlie E. Bugham.....	Denver, Colo.
Chas. A. Hill.....	Amarillo, Tex.
Herman E. Oerter.....	Gonzales, Tex.

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CERTIFIC

From.....

Date

Total of Credits accepted.

Condition of Entrance.....

Passed on by the Commi

College Credits this.....

of.....

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NEW MEXICO SCHOOL OF MINES
SOCORRO, NEW MEXICO

Certificate of Entrance Credits

THIS CERTIFIES THAT _____ has graduated from
the High School at _____, State of _____
in the year 192____, and has completed the following subjects as indicated below:

Note: If the student has not graduated cross out the words underscored above

	Number weeks pursued	Hours per week	Stand- ing	Credits		Number weeks pursued	Hours per week	Stand- ing	Credits
Latin					Physiology				
Spanish					Geology				
German					El. Physics				
French					Chemistry				
Scandinavian					Am. Literature				
E. Algebra					Eng. Literature				
Adv. Algebra					Comp. and Rhetoric				
Pl. Geometry					El. Psychology				
Sol. Geometry					El. Economics				
Trigonometry					El. Pedagogy				
U. S. History					Civics				
General History					Phys. Geography				
Medieval History									
Modern History									
English History									
Zoology									
Biology									
Botany									

Age _____ years. Recitation period..... minutes. Number of subjects pursued each term or semester
Laboratory period minutes.
_____, 192____

Note—Place no figures in the column headed "Credits."

Superintendent or Principal.

(OVER)

NOT TO BE FILLED BY APPLICANT

CERTIFICATE OF

From.....

Date

Total of Credits accepted.....

Condition of Entrance.....

Passed on by the Committee on Entrance and

College Credits this.....day

of....., 192....

Secretary of Committee.

BY APPLICANT

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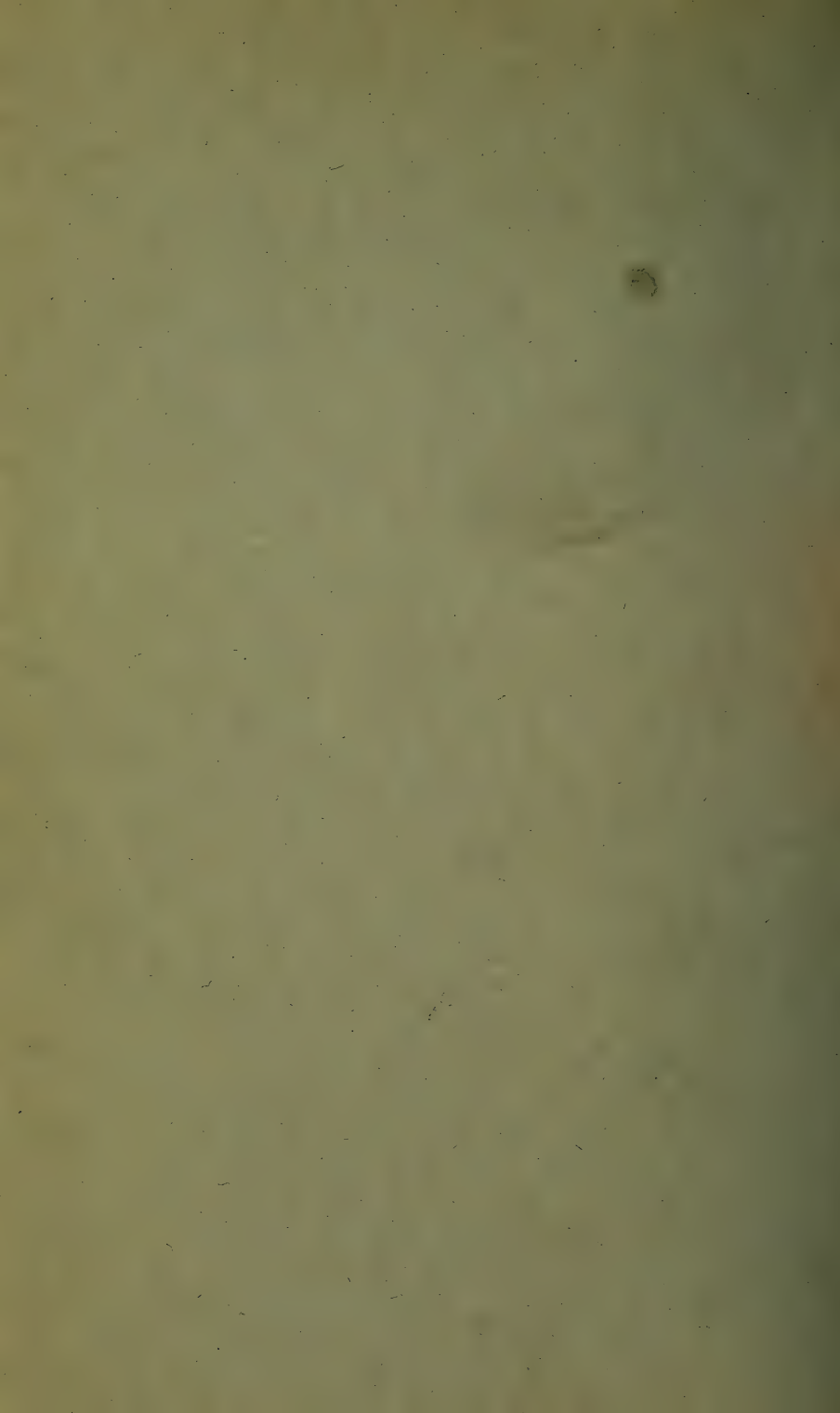
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